Initial Environmental Examination

June 2016

BHU: Thimphu Road Improvement Project (TRIP)

Prepared by the Department of Engineering Services (DES), Ministry of Works & Human Settlement, Royal Government of Bhutan for the Asian Development Bank

CURRENCY EQUIVALENTS
(as of 20 July 2016)

Currency unit	–	ngultrum (Nu)
Nu1.00	=	$0.01489
$1.00	=	Nu67.14430

ABBREVIATIONS

ADB	–	Asian Development Bank
BoQ	–	Bill of Quantities
BSR	–	Bhutan Schedule of Rates
DoR	–	Department of Roads
FGD	–	Focused Group Discussion
GRC	–	Grievance Redress Committee
GRM	–	Grievance Redress Mechanism
IEE	–	Initial Environmental Examination
LRO	–	Land Record Officer
MoWHS	–	Ministry of Works and Human Settlement
NFE	–	Non Formal education
NLC	–	National Land Commission
O&M	–	operation and maintenance
PAVA	–	Property Assessment and Valuation Agency
PIU	–	Project Implementation Unit
PMU	–	Project Management Unit
RECOP	–	Regulation for the Environmental Clearance of Projects
ROW	–	Right of Way
SPS	–	Safeguard Policy Statement
ToR	–	Terms of Reference

WEIGHTS AND MEASURES

AADT	–	annual average daily traffic
dB (A)	–	decibel (A-weighted)
masl	–	meters above sea level
km	–	kilometer
km/h	–	kilometer per hour
m	–	meter
m^3	–	cubic meter
m^2	–	square meter

NOTES

In this report, "$" refers to US dollars.

In preparing any country program or strategy, financing any project, or by making any designation of or reference to a particular territory or geographic area in this document, the Asian Development Bank does not intend to make any judgments as to the legal or other status of any territory or area.

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I. INTRODUCTION

A. Project Background

1. There has been a rapid growth in the total number of vehicles in Bhutan with an average annual growth rate of 11%. A bulk of this vehicular growth has occurred in Thimphu where the number of vehicles has increased by 5.2% in the last year alone.[1] In recent years the municipality has also undertaken the planned expansion of Thimphu city through the Asian Development Bank (ADB)[2] and the World Bank assistance for the development of local area plans (LAPs which are primarily for housing) in the south and the north of the city, respectively. This planned urbanization led to an unprecedented construction boom, which coupled with the increase in vehicular traffic has severely damaged the road infrastructure (including footpaths and drains) in several parts of the city, particularly the southern LAPs.[3] LAP that was implemented under ADB-funded Urban Infrastructure Development Project[4] was one of rare successful cases of land-pooling scheme in the developing world and, therefore, it is very important to maintain the significant benefits that were realized for its wider and continued replication in the future. Road repairs and improvements in Thimphu are now a top priority of the Government with road safety and traffic management being the key concerns.[5] The Government, hence, requested ADB's urgent support to improve road infrastructure in the city.

2. To address these challenges the Thimphu Road Improvement project (TRIP) will support the rehabilitation and upgrading of road infrastructure in the four zones of Thimphu city. The project outputs are:

(i) Repair, resurfacing and improvements of roads in Thimphu Thromde (Municipality); and
(ii) Capacity for project management and O&M strengthened for government and Thromde officials.

B. Purpose of the Report

3. The objectives and scope of this Initial Environmental Examination (IEE) are to (i) assess the existing environmental conditions of the project area; (ii) identify potential environmental impacts from the proposed works; (iii) evaluate and determine the significance of the impacts; (iv) develop an environmental management plan (EMP) detailing mitigation measures, monitoring activities, reporting requirements, institutional responsibilities and cost estimates to address adverse environmental; impacts, and (v) carry-out public consultations to document any issues/concerns and to ensure that such concerns are addressed in the project design. The IEE is done under the guidance of the policies of the ADB and the Royal Government of Bhutan (the Government) and includes chapters on description of the project,

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[1] Source: Ministry of Information and Communication. The number of vehicles in Thimphu went up from 38,570 in April 2015 to 40,575 in April 2016. The increase experienced between 2014-2015 has been even sharper at 6.75%.

[2] Four LAPs were constructed in southern Thimphu through funding from Loan 2258 (Lungtenpu, Babesa, Simtokha and Changbandu).

[3] The roads were designed for normal traffic conditions and the design did not anticipate such a heavy influx of heavy construction vehicles in the residential and commercial streets of Thimphu that has caused damage, which could not be repaired/restored by routine maintenance.

[4] ADB. 2006. *Report and Recommendation of the President to the Board of Directors: Proposed Loan and Technical Assistance Grant to the Kingdom of Bhutan for Urban Infrastructure Development Project*. Manila (Loan 2258-BHU).

[5] Several sections of the city's roads are riddled with potholes and suffer from water logging due to poor drainage.

environmental impacts and mitigation measures, mitigation and monitoring plan, and public consultation procedures.

C. Methodology Adopted for IEE

4. The IEE study has followed the guidelines of the government and ADB. The study has been conducted through review of secondary information collected from relevant agencies, and primary information collected from the field surveys in February and May 2016. Public consultations and disclosure were carried out and the concerns of project area/affected persons are documented. The relevant Thimphu Thromde officials were contacted to verify information collected and also to solicit their concerns. Based on the analysis of information, the impacts have been predicted, mitigation measures prepared and a monitoring plan has been developed.

II. POLICY AND LEGAL FRAMEWORK

A. Environmental Regulatory Compliance

5. The implementation of the Project will be governed by Asian Development Bank Safeguard Policy Statement (SPS, 2009) and the environmental laws, policies and regulations of the government.

6. **Asian Development Bank.** The ADB SPS stipulates addressing environmental concerns, if any, of a proposed activity in the initial stages of project preparation. For this, the ADB SPS categorizes the proposed components into categories (A, B or C) to determine the level of environmental assessment required to address the potential impacts. The Project has been categorized as B. Accordingly this IEE is prepared to address the potential impacts in line with the SPS. Stakeholder consultation was an integral part of the IEE which was carried out and an EMP specifying mitigation measures to be adhered to during implementation of the Project has been prepared.

7. **Royal Government of Bhutan.** The implementation of the Project will also be governed by laws, regulations, and standards for environmental assessment and management of the government. Table 1 summarizes the main requirements of the government for environmental management that will apply to the Project.

Table 1: Government Environmental Policies, Laws, Regulations, and Standards

Statute	Outline	Relevance
Environmental Assessment Act, 2000	This Act establishes procedures for the assessment of potential effects of projects on the environment, and aims to determine measures to reduce potential adverse effects and to promote environmental benefits.	• To ensure that all foreseeable impacts on the environment, including cumulative effects are fully considered prior to any irrevocable commitments of resources or funds. • To ensure that all feasible alternatives are fully considered.

Statute	Outline	Relevance
Regulation for The Environmental Clearance of Projects (RECOP), 2002	Regulation for Environmental Clearance of Projects (RECOP) defines responsibilities and procedures for the implementation of the Environmental Assessment Act, 2000 for issuance and enforcement of environmental clearances.	• To ensure that all projects are implemented in line with the sustainable development policy of the Royal Government of Bhutan • To ensure that all feasible means to avoid or mitigate damage to the environment are implemented; and • To ensure that concerned people benefit from projects in terms of social facilities.
National Environment Protection Act, 2007	The aim of this Act is to enable an effective system of conserving and protecting Bhutan's environment. This system is constituted of the National Environment Commission or other designated Competent Authorities and advisory committees responsible for independently regulating and promoting sustainable development in an equitable manner.	• The Act provides a framework for developing measures and standards to protect Bhutan's environmental quality. Guidance relevant to this project includes: • Handling of hazardous substances: No person shall handle or cause to be handled any hazardous substance except in accordance with such procedure and after complying with such safeguards as may be prescribed under national and international instruments. • Discharge of environmental pollutants: No person shall discharge or emit or be permitted to discharge or emit any pollutants in excess of such standards as may be prescribed.
Waste Prevention and Management Act of Bhutan, 2009	The Waste Prevention and Management Regulation 2012 is adopted under section 53 of the Waste Prevention and Management Act, 2009. This Act defines the institutional framework for preventing and managing waste in Bhutan, including the establishment of sound waste management system, including monitoring procedures at every organizational level, through efficient collection, segregation, treatment, storage, transportation, reduction, reuse, recycling and safe disposal of solid, liquid and gaseous wastes. It sets out the principles, measures, mechanisms and responsibilities for reduction, segregation, and appropriate disposal of waste to protect the country's environment. The act also provided the requirements for the management of hazardous wastes to include: labeling, pre-treatment process, storage, record keeping,	• Waste management requirements of relevance to the proposed development include: • Non-hazardous waste: Implementing agencies shall ensure that the reduction, reuse, recycling and disposal of non-hazardous waste are addressed in an environmentally sound manner to ensure compliance with the Act • Hazardous waste: Implementing agencies shall prevent manufacturing of products with potential to generate hazardous waste. The agencies shall also ensure that the reduction, storage, treatment, and disposal of hazardous waste are addressed in an environmentally sound manner to ensure compliance with the Act

Statute	Outline	Relevance
	transportation, and disposal of hazardous waste by the generator. Sanctions and penalties are provided for non-compliance.	
General Rules and Regulations on Occupational Health and Safety (OHS) In Construction, Manufacturing, Mining and Service Industries, 2006	OHS Rules and Regulations aims to assure safe and healthful working conditions for working men and women as well as other persons present at workplaces from work related risks to their health, safety, and well being	During Construction and operation stage of the project.
The Labour and Employment Act of Bhutan, 2007	The labour and employment act of Bhutan 2007 provide policies and programs in the areas of employment promotion, labour protection and relations, vocational education and training, and occupational standards setting and certification.	The proposed development will adhere to the policies provided under different sections of the Act.
The Forest Act (1969).	The first environmental legislation in Bhutan. It brought all forest resources under government custody to regulate utilization.	This was repealed with the enactment of the FNCA in 1995
Forest and Nature Conservation Act (FNCA) 1995	Allows community stewardship of forests and aims to provide protection and sustainable use of forests, wildlife, and related natural resources.	Schedule I of the Act, lists those wild animals and plants that are given full protection under the Act. The FNCA establishes that all forests in Bhutan are Government Reserved Forests (GRF), and prohibits any development activity in these areas except with a permit.
Forest and Nature Conservation Rules (FNCR) 2000	Under powers established by the FNCA, the Ministry of Agriculture promulgated the FNCR in 2000, which was revised in 2006.	Amongst other things the FNCR allows for: 1. Allotment of land and land rights in GRF; 2. Prohibitions, restrictions and concessions in GRF; 3. Transport and trade of forest produce; 4. Declaration and administration of protected areas; 5. Protection of wildlife and use of certain wild species; 6. Prevention of forest fires, land clearance, and activities potentially impacting soil, water and wildlife resources; and Enforcing penalties for offences related to these and other aspects of the FNCR.

Statute	Outline	Relevance
Land Act 1979 (Revised 2007)	The Land Act 1979 provides the basis for land tenure in Bhutan was revised in 2007 to streamline many provisions in the Land Act. One major Change was the establishment of an autonomous National Land Commission Secretariat which has been given full responsibility for all matters pertaining to land registration. Land categories have been reduced to seven including i) Chhuzhing (wetland), ii) Kamzhing (dry land) including orchard, iii) Khimsa (Residential land), iv) Industrial land, v) Commercial land, vi) Recreational and vii) Institutional land.	7. Under this Act, there are provisions for acquisition of land by the Government, if it is required for the benefit of the country. In such cases, the affected person will be compensated with substitute land from the same Dzongkhag or given cash compensation depending on the land classification as per the prevailing land compensation rate determined by the Act. If a house is acquired, compensation is paid on the basis of an evaluation carried out by a qualified engineer appointed by the competent authority.

FNCA = Forest and Nature Conservation Act; FNCR= Forest and Nature Conservation Rules; GRF= Government Reserved Forests; OHS= Occupational Health and Safety

8. The policy, legal, and administrative frameworks relevant to the environmental assessment of infrastructure projects in Bhutan have been established by the following laws and regulations: (i) the National Environmental Protection Act of 2007, (ii) the Environmental Assessment Act of 2000, and (iii) Regulation for Environmental Clearance of 2002. At the national policy level, environmental protection and conservation is a constitutional mandate to:

(i) Protect, conserve, and improve the pristine environment;
(ii) safeguard biodiversity; and
(iii) Prevent pollution and ecological degradation.

9. The National Environmental Protection Act of 2007 is the overall law on environmental protection and specifies the powers, functions, and operational framework of the National Environment Commission (NEC), the government agency with responsibility for all issues related to the environment. Their mandate includes the maintenance of environmental quality through the enforcement of environmental standards and promotion of best environmental management practices to address pollution and environmental hazards.

10. The Environmental Assessment Act of 2000 was enacted to establish procedures for the assessment of the potential effects of strategic plans, policies, programs, and projects on the environment, and for the determination of policies and measures to reduce potential adverse effects and to promote environmental benefits. Under this law, no development consent can be issued without first seeking an environmental clearance. The permission is given under Chapter III of the act and is issued in writing by the secretariat or the competent authority, to let a project proceed, which includes terms to ensure that the project shall be managed in an environmentally sound and sustainable way.

11. The Application for Environmental Clearance Guidelines for Highways and Roads and Guideline for Urban Development have been promulgated by the NEC. Project information consistent with an IEE report will be required under general provisions including requirements

for no-objection certificates that are provided by affected parties that include but are not necessarily limited to those presented in Table.2.

Table 2: No Objection Statements required

Agency/concerned people to issue NOC	Yes /No	Why/when
Environment Section, Ministry of Works and Human Settlement	Yes	Approval from the Ministry
Department of Forests	NA	Project does not involve felling of trees, or riverside quarrying or small-scale quarrying
Nature Conservation Division	No	Required only if project lies within boundary of a Protected Area
Municipal Authority	Yes	Project is located within the municipal boundary
Department of Health	No	within 50m of hospital
Department of Energy	NA	Project will not require the relocation of power transmission line
Bhutan Telecom Authority	NA	Project will not require relocation of telephone lines
National Environment Commission	NA	As per RECOP the Ministry of Works & Human Settlements is the competent authority to screen and issue the environment clearance.

B. Environmental Clearance Requirements

12. Article 33.1 of the Environmental Assessment Act 2000, grants the competent authority (CA) a power to screen, issue or deny the environmental clearance of the activities or project listed under Annex 2 of RECOP 2002. However, the executing agency (MoWHS) cannot issue an environmental clearance to itself or the Departments directly under it; even for the listed activities of the RECOP. However, it can issue the clearance to organizations like Thimphu Thromde; which is an autonomous organization.

13. However, the Thimphu Thromde is obliged to fill up the standard IEE forms and submit it to the MOWHS along with the no objection certificates (NOC) from the affected persons/ public and other stakeholders.

Table 3: Environmental Regulatory Compliance

	Royal Government of Bhutan		ADB	
Component Description	**Competent Authority in accordance with ECR**	**Environmental Assessment**	**Category in accordance with SPS**	**Environmental Assessment**
Road improvements under TRIP	MoWHS/NACSQC - NEC	Environmental Information	Category B **	IEE and EMP

ADB = Asian Development Bank, ECR* = Environmental Clearance Regulations, EMP = Environmental Management Plan, IEE = Initial Environmental Examination, NACSQC- NEC= National Authority for Construction Standards and Quality Control, SPS = Safeguard Policy Statement. ** Nothing is envisaged at this stage that could cause reclassification to Category A.

C. Occupational Health and Safety

14. The Project will conform to the labour laws and occupational and health related rules as outlined in Table 4.

Table 4: Relevant Occupational Health and Safety Laws and Rules

Title	Year	Overview
Labour and Employment Act 2007, Bhutan	2007	The L&E Act, 2007 provides general legislation governing employment conditions and environment at work. The aim of the Act is to improve the work environment and working conditions in order to safeguard and maintain the employees' work ability, and to prevent occupational accidents, diseases, and other physical or mental health problems related to work. Employers are required to identify the hazards and risk factors at workplace, eliminate, and assess the effects of the remaining risks to the employees' health and safety. The Act describes the employers and employees general duties, rights and obligations in pursuing a healthy and safe workplace. The Act also emphasizes reporting system for workplace injury and diseases and the requirement of the enterprise to develop health and safety policy at the enterprise level.
Mines and Mineral Act, 1995	1995	The Department of Geologies and Mines under the Ministry of Economic Affairs are responsible for implementing the Mines and Mineral Act, 1995. Under the Mines and Mineral Act, 1995 the employers or lessees are responsible to ensure a safe and healthy working environment. They should report any workplace accident to the ministry. The ministry is also empowered to frame regulations and standards on health and safety in keeping with the view of national legislation on occupational health and safety.
Mines and Minerals Management Regulations 2002. (MoEA)	2002	This regulation clearly outlines Occupational Health and Safety procedures to be followed by the mining industries.
Road Safety and Transport Act, 1999	1999	The objectives of the Road Safety and Transport Act 1999 are to provide safe and efficient use of road systems and to provide an efficient and a safe public transport system. This responsibility is shouldered by the RSTA. The Act also describes general duties of the drivers related mainly to traffic safety signs and safety procedures in order to prevent transport accidents.
Electricity Act of Bhutan, 2001	2001	The Act provides authority to the Bhutan Electricity Authority to develop regulations, standards, codes, principles & procedures, which include performance standards, including minimum technical & safety requirements for construction, operation & maintenance of generation, transmission& distribution facilities.
Pesticides Act of Bhutan 2000	2000	The objectives of this act are to minimize deleterious effect of pesticides on human beings and the environment. Guidelines direct the import procedures of pesticides and the use of pesticides in a way that the effect on the environment is mitigated.
Food Act of Bhutan 2005 Regulations on	2005	The purpose of this act is to protect human health from consumption of food which has adverse effect on the health and to regulate and facilitate the import, export and trade of food in the country. This regulation was framed under the Labour and Employment Act,

Title	Year	Overview
Regulations on Occupational Health, Safety and Welfare (MoLHR)	2007	It prescribes standards and procedures on occupational health, safety and welfare for workplaces, instruments, vessels, appliances, apparatuses, tools, devices, electrical safety and other hazardous conditions. The objective of this regulation is to ensure safety, health and welfare for employees as well as other persons at workplaces, from work related risks to their health, safety and wellbeing.
Regulations on Occupational Health and Safety for Construction Industry (MoLHR)	2009	Regulation on Occupational Health and Safety for the Construction Industry was framed under the Labour and Employment Act, 2007. This regulation establishes occupational health and safety standards and procedures on construction safety. It aims to ensure safety and health for employees, as well as other persons at the construction sites, from work related risks to their health, safety, and wellbeing. It also prescribes the roles and responsibilities of the workers and employers in ensuring health and safety at the site.
Regulation on Workers Compensation 2009 (MoLHR)	2009	Regulation on Workers Compensation was notified by MoLHR as empowered by the Labour and Employment Act, 2007. It establishes standards and procedures for compensation of employees and their dependents as a result of injury, diseases or death arising from their work or related to the tasks and duties they are required to perform. It aims to compensate employees or their dependents for a loss of earning capacity rather than compensate for a particular injury or disease, and provides for the payment of medical and related costs and the rehabilitation of employees to enable them to return to work as soon as possible.
Regulation on Hours of Work 2009 (MoLHR)	2009	This regulation was framed as per the Labour and Employment Act, 2007 and it provides the maximum working hour and related matters falling within the scope of the Labour Act. It prescribes a maximum of 8 working hours per day with 2 hours overtime per day.
Bhutan Building Rule 2002 (MWHS)	2002	The City Corporation Offices of the respective towns have the responsibility to enforce the Bhutan Building Rules, 2002, which make reference to aspects of safety on construction sites.

Source: Profile on the Occupational Health and Safety of Bhutan, March 2012

D. International Conventions

15. Bhutan is a party to several international conventions that are relevant to environmental management. Bhutan ratified the Convention on Biological Diversity and the United Nations Framework Convention on Climate Change (25 August 1995). These international conventions explicitly reference the application of environmental assessment to address the effects of human activities. The Convention on Biological Diversity, in particular, promotes the use of appropriate procedures requiring environmental impact assessment of proposed projects that are likely to have significant adverse effects on biological diversity. Bhutan acceded to the Convention on Biological Diversity (CBD) on 10 October 2006, and became a Party to the Convention on 8 January 2007. It also acceded to the Convention to Combat Desertification (CCD) in 2003 and ratified the Framework Convention on Climate Change (FCCC) in 2006. Local conservation legislation is still in the development stage.

E. Environmental Roles of Relevant Agencies

1. National Environmental Commission Secretariat (NECS)

16. NECS has overall responsibility for enforcing environmental assessment and management in Bhutan. Various functions and responsibilities have been delegated to

ministries and competent authorities. NECS will be directly involved in the environmental management of the proposed project as requested by the secretariat as there is no appropriate delegation of authority in this case. In general NECS issues the environmental clearance and provides guidance when needed. But for this project, as per RECOP, the MoWHS is the competent authority to screen and issue environment clearance.

2. Ministry Level Environmental Committee (DEC)

17. A District Environmental Committee (DEC) consists of Dzongkhag planning officer, Dzongkhag forest officer, Dzongkhag land record officer, Dzongkhag agriculture officer, Dzongkhag environmental officer, and Dzongkhag engineer. The District Environmental Officer (DEO) is district official of NECS. DEC is responsible for issuing Environmental Clearance to some project activities mandated to the committee and for checking compliance of the projects to which it issues EC periodically. As part of its regular activities, NECS gives general training and orientation to DEOs before sending them to districts. These orientations focus mainly on Bhutan's environmental requirements.

3. Thromde Level Environmental Committee (DEC)

18. Currently Thimphu Thromde has separate Environment Division headed by a Division Chief with 17 staff. The mandate includes environment compliance monitoring, disaster management among others. A regular check on various construction activities within the Thromde is mandated to the Division.

III. DESCRIPTION OF THE PROJECT

A. Location and Project Type

19. Thimphu Dzongkhag has a total of 560km of roads.[6] Thimphu Thromde has a total of 243km[7] of urban roads spanning from Dechencholing in the north to Babessa in the south. The road composition varies from primary, secondary and access/tertiary roads. Some of the existing roads require urgent repair and maintenance works due to the rapid urbanization and construction boom that the city has witnessed over the past few years. As a priority project the government has decided to undertake the road repair works in a significant way in order to improve the urban transportation infrastructure of the city. The project includes two kinds of works: (i) road resurfacing and repair including construction of drainage and footpaths; and (ii) road widening works along one stretch of primary road. The road repair works include resurfacing of 32.99 kilometers (km) of urban roads and construction of 9.15 km of drainage and 4.83 km of footpath. An additional 4,239 square meters (m^2) of parking space will be improved by resurfacing. Construction of foot paths and road approaches will also be tailored to be user friendly for the differently-abled people. The road widening section will increase the width of 3.54 km of road stretch spanning from Mani Dungkar to YHSS junction. In addition, the concerned engineers of the Thimphu Thromde will also be trained on project planning, design, and operation and maintenance (O&M).

[6] Statistical Year Book of Bhutan 2015, NSB.
[7] Thimphu Thromde, Road Division.

B. Project Category

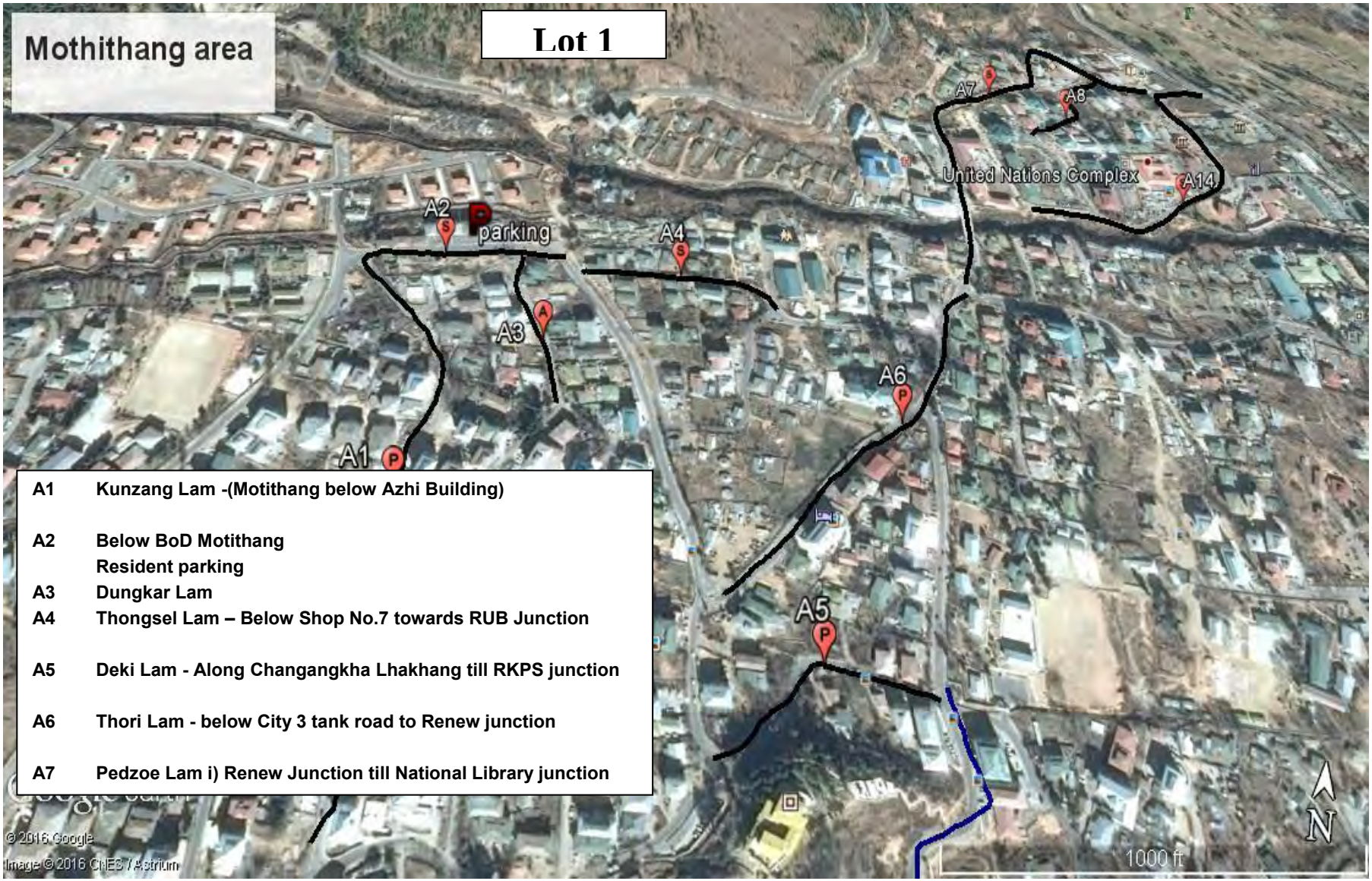
20. The project categorization has been done using the Rapid Environmental Assessment (REA) checklist of ADB for roads and highways based on filed examinations and consultations with key stakeholders. Land acquisition will not be needed for road widening and ancillary road improvement works as such anticipated works fall within the right of way, the land for which is under government (Thimphu Thromde) ownership. The location of the works is restricted to urban areas are located within or nearby any wildlife sanctuary, national park, protected area network, archaeological monument/ heritage sites or any other similar eco-sensitive areas. Further, no tress will need to be cleared for implementing the project.

21. Based on the above and as per the approach identified in ADB's SPS both types of works (road widening and road repairs) are classified as Category B. As per Environmental Assessment Act 2000 and Regulation for the Environmental Clearance of Projects 2002, Annex-2 (pg 20-22 of RECOP[8]) it is clearly stated *that "Road resurfacing, Road maintenance, Road improvement (base course, black topping and permanent works) DO NOT require Environment Clearances*. Other works such as Road Widening/curve improvement, construction of urban drainage, permanent works (retaining walls, breast wall, causeways), the competent Authority for screening and issuing Environment Clearance for such activities is the Ministry of Works and Human Settlements.

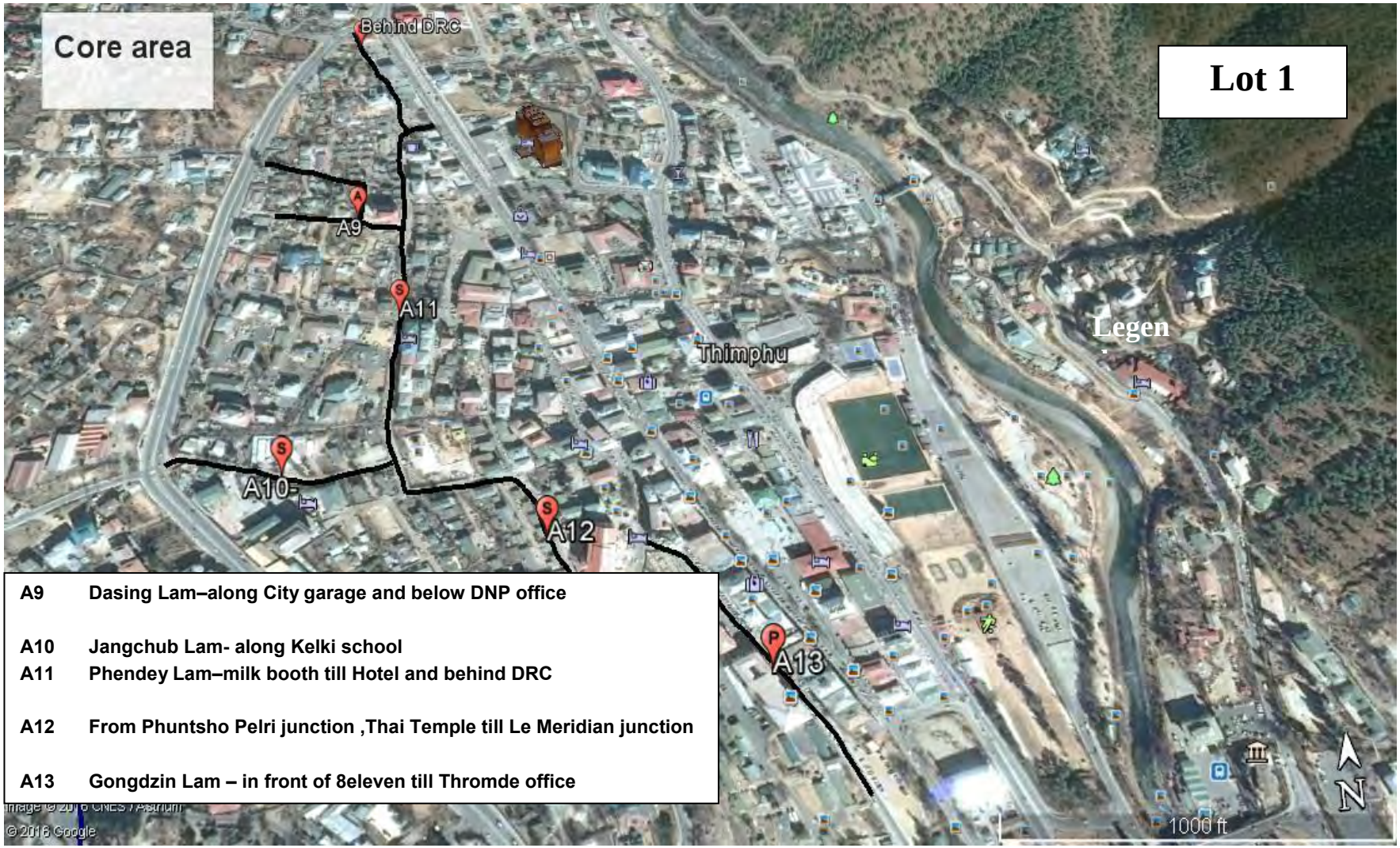
C. Project's Geographic Spread

22. The project will undertake repairs in 74 road sections throughout the city, which are presented in Maps 1 to 11 below. Tables 5-8 further provide the scope of works to be undertaken within each road section.

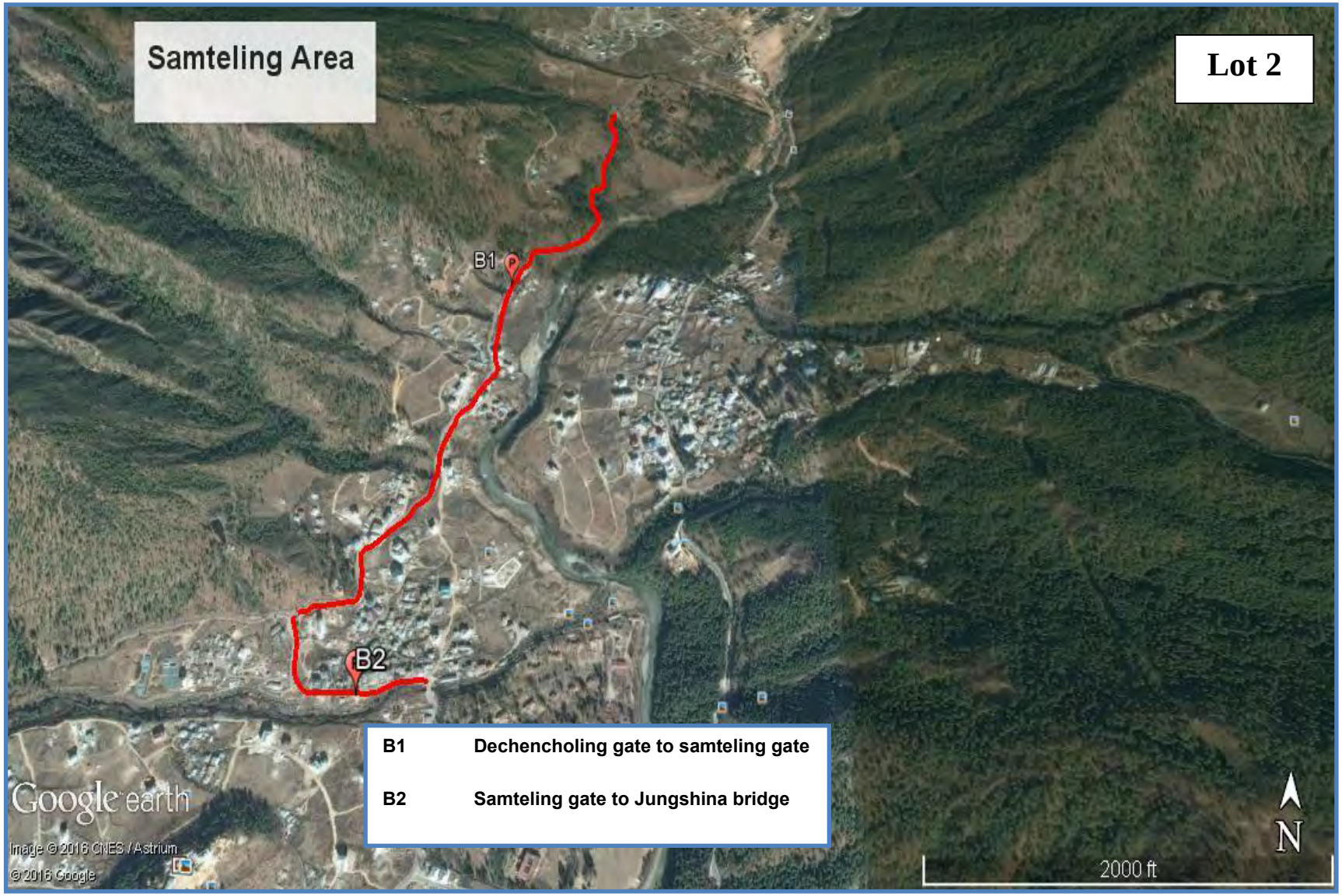
[8] Regulations for the Environmental Clearance of Projects.



A1	**Kunzang Lam -(Motithang below Azhi Building)**
A2	**Below BoD Motithang Resident parking**
A3	**Dungkar Lam**
A4	**Thongsel Lam – Below Shop No.7 towards RUB Junction**
A5	**Deki Lam - Along Changangkha Lhakhang till RKPS junction**
A6	**Thori Lam - below City 3 tank road to Renew junction**
A7	**Pedzoe Lam i) Renew Junction till National Library junction**

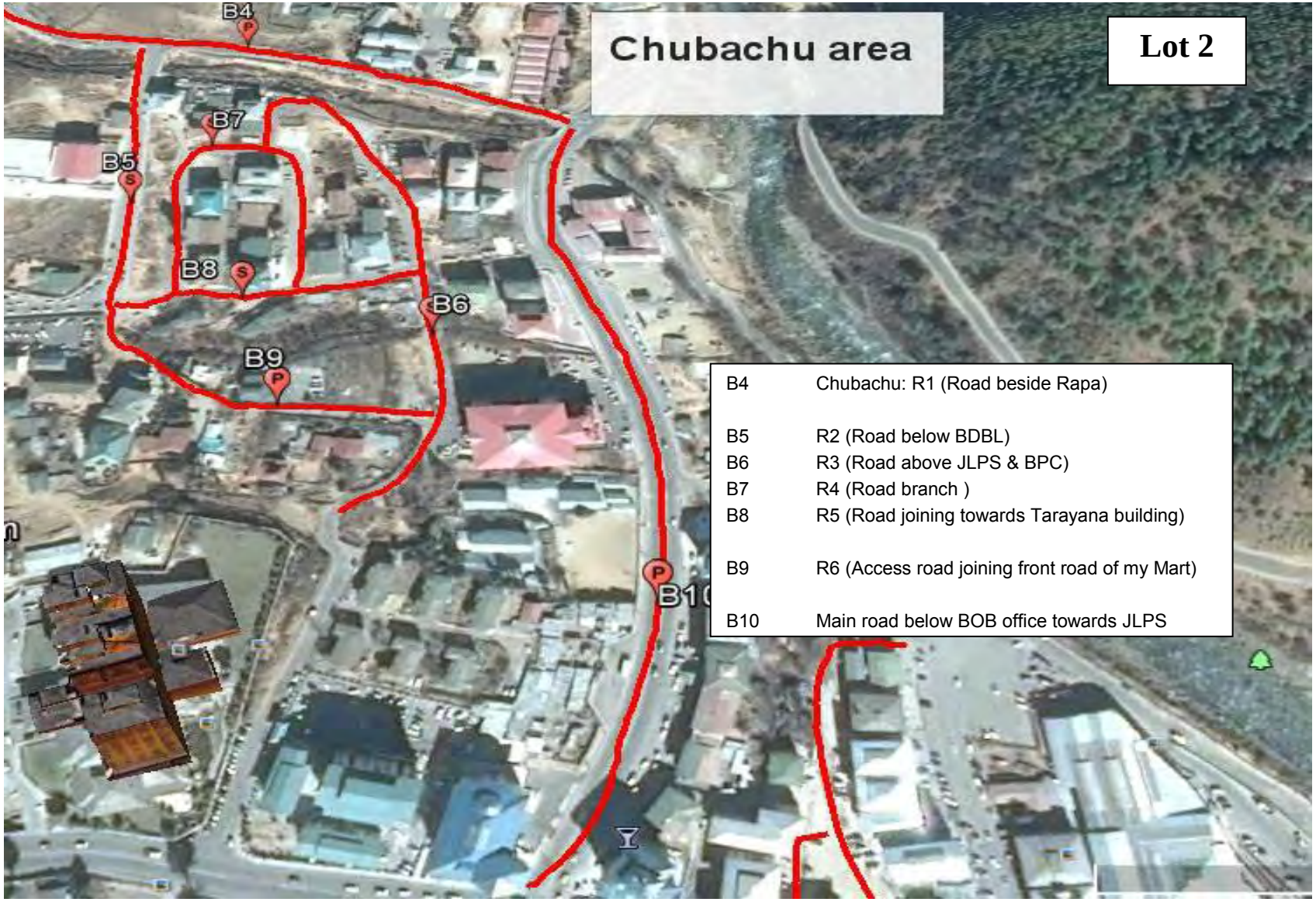


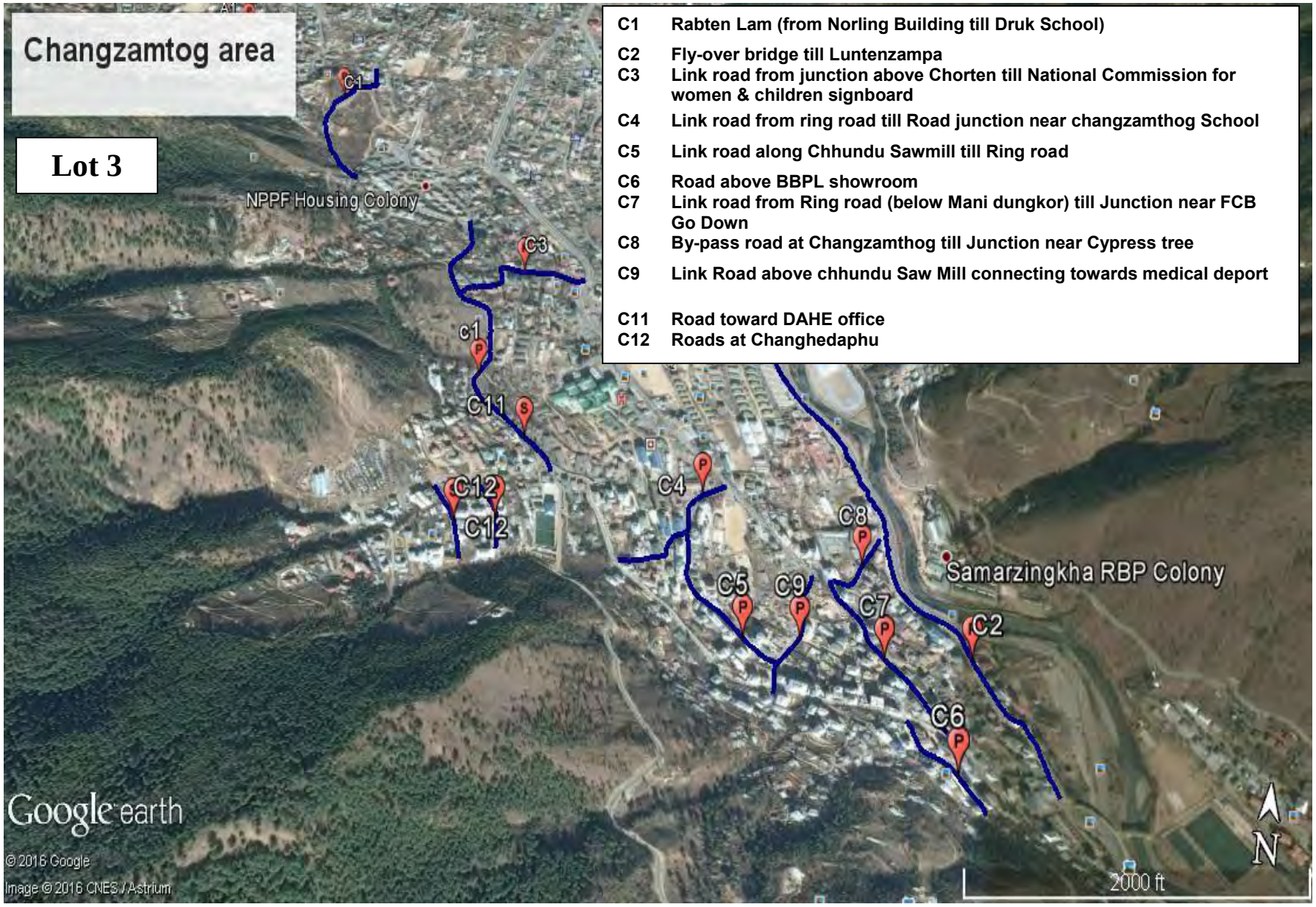
A9	**Dasing Lam–along City garage and below DNP office**
A10	**Jangchub Lam- along Kelki school**
A11	**Phendey Lam–milk booth till Hotel and behind DRC**
A12	**From Phuntsho Pelri junction ,Thai Temple till Le Meridian junction**
A13	**Gongdzin Lam – in front of 8eleven till Thromde office**


Samteling Area
Lot 2
B1
B2
B1 Dechencholing gate to samteling gate
B2 Samteling gate to Jungshina bridge
Google earth
Image © 2016 CNES / Astrium
© 2016 Google
N
2000 ft

B3 Towards court to dzong gate


Vegetable Market area
Lot 2
B12
B11
B13
B14
B15
B11 R1(Behind vegetable market)
B12 R2(Road behind vegetable market branch)
B13 R3(Road towards vegetable market)
B14 R4(Road towards vegetable market)
B15 R5 (Road towards changlam from vegetable market):
B1 Dechencholing gate to samteling gate
Google earth
Image © 2016 CNES / Astrium
© 2016 Google
300 ft
N


Chubachu area
Lot 2
B4
B5
B6
B7
B8
B9
B10
B4 Chubachu: R1 (Road beside Rapa)
B5 R2 (Road below BDBL)
B6 R3 (Road above JLPS & BPC)
B7 R4 (Road branch)
B8 R5 (Road joining towards Tarayana building)
B9 R6 (Access road joining front road of my Mart)
B10 Main road below BOB office towards JLPS



C1	Rabten Lam (from Norling Building till Druk School)
C2	Fly-over bridge till Luntenzampa
C3	Link road from junction above Chorten till National Commission for women & children signboard
C4	Link road from ring road till Road junction near changzamthog School
C5	Link road along Chhundu Sawmill till Ring road
C6	Road above BBPL showroom
C7	Link road from Ring road (below Mani dungkor) till Junction near FCB Go Down
C8	By-pass road at Changzamthog till Junction near Cypress tree
C9	Link Road above chhundu Saw Mill connecting towards medical deport
C11	Road toward DAHE office
C12	Roads at Changhedaphu


Changbangdu area
Lot 3
C14
C14
C14
C13 Straight road near by election office(rigid pavement)
C14 Changbandu road
Google earth
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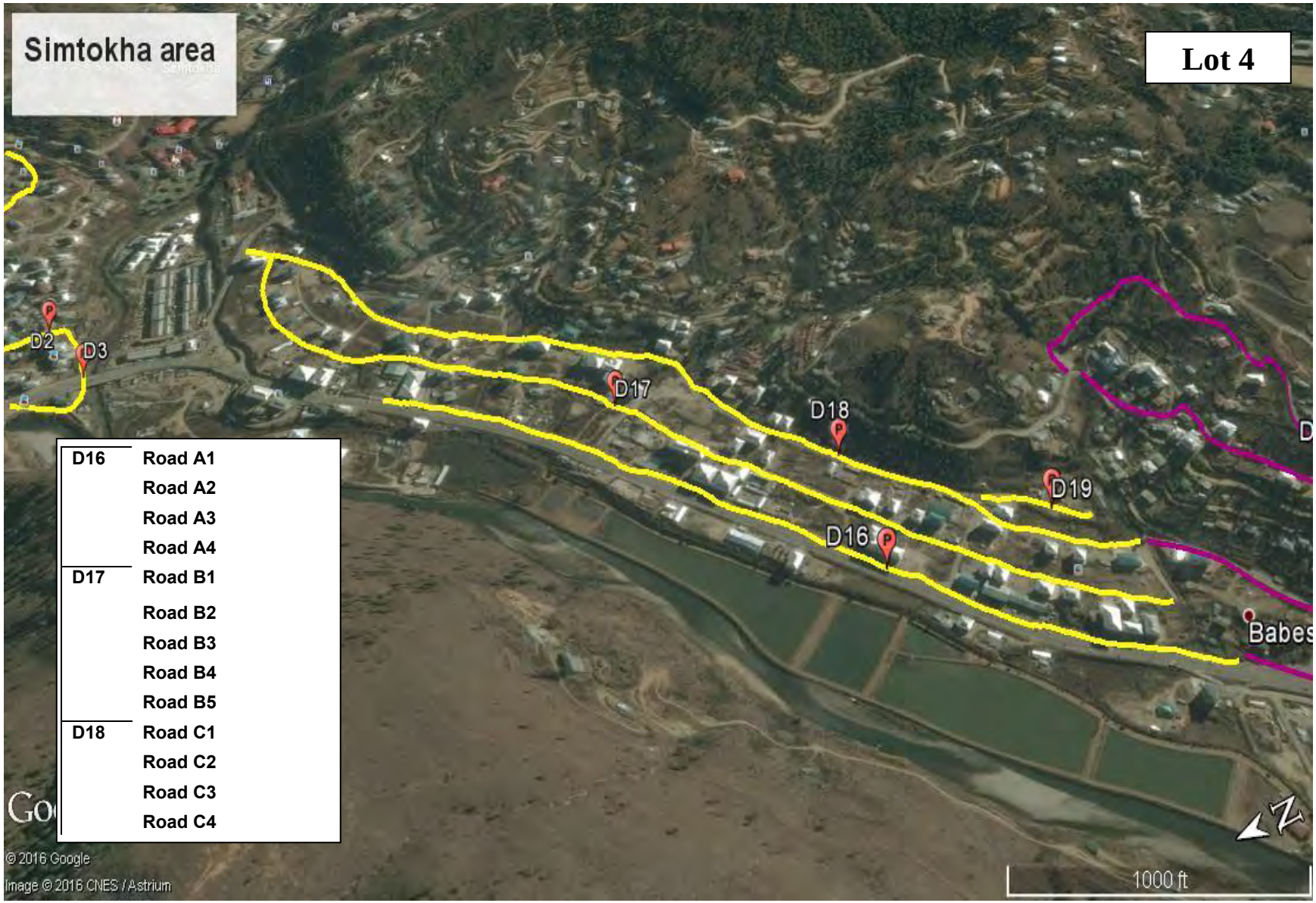
Simtokha area
Lot 4
D2
D3
D17
D18
D19
D16
Babes
D16 Road A1
Road A2
Road A3
Road A4
D17 Road B1
Road B2
Road B3
Road B4
Road B5
D18 Road C1
Road C2
Road C3
Road C4
© 2016 Google
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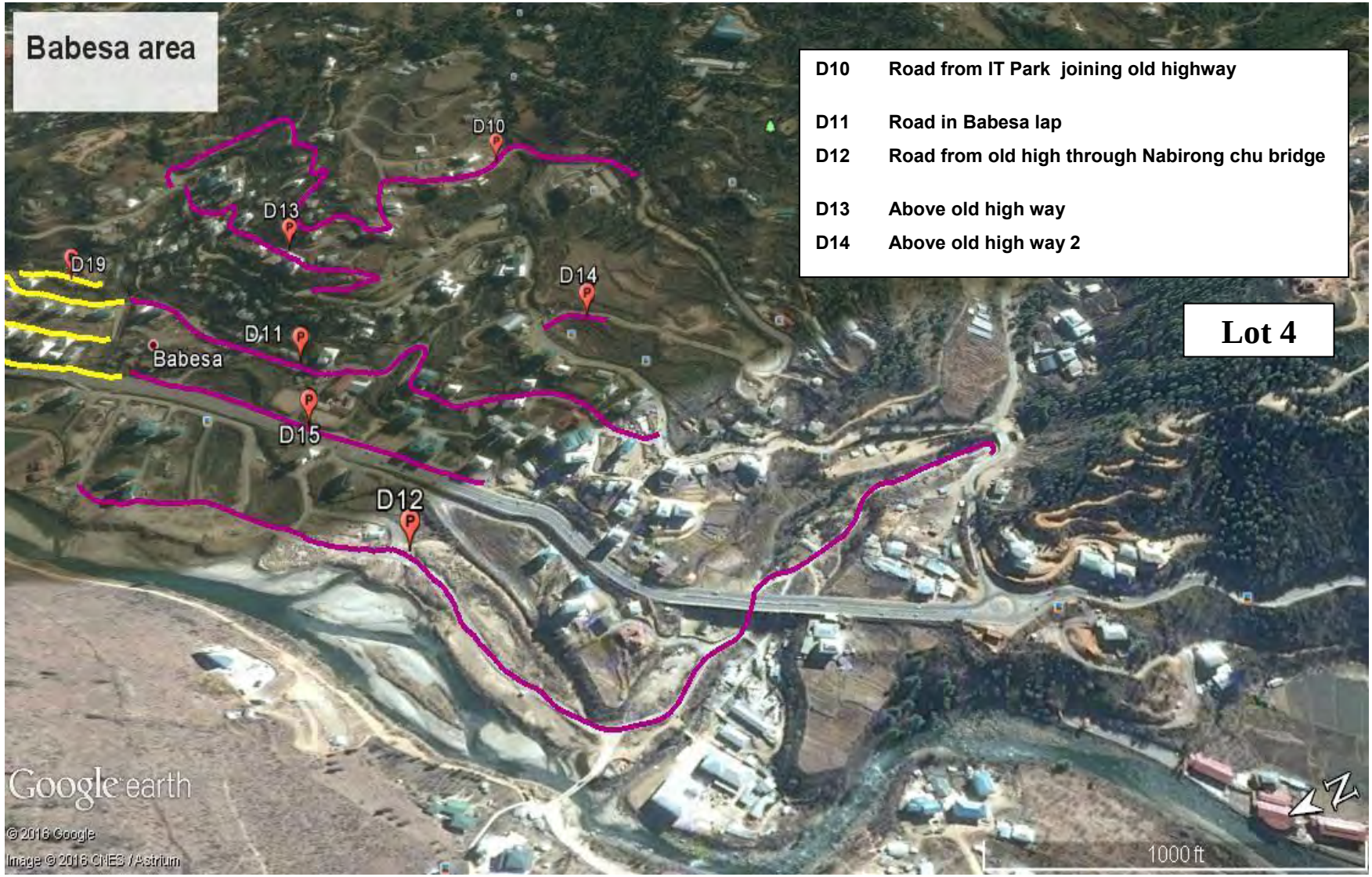
Babesa area
D10 Road from IT Park joining old highway
D11 Road in Babesa lap
D12 Road from old high through Nabirong chu bridge
D13 Above old high way
D14 Above old high way 2
Lot 4
D10
D13
D19
D14
D11
Babesa
D15
D12
Google earth
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1000 ft
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Olakha area
Lot 4
Semtokha
D9
D5
D8
D6
D1
D2
C13
D3
D4
D7
Google earth
© 2016 Google
Image © 2016 CNES / Astrium
D1 In front of Election office
D2 Road below bridge
D3 Road below bridge 2
D4 Road in front of shree square till election office junction
D5 4th road from top
D6 4th road from top 2
D7 Road from express way till old high way
D8 2nd road

Proposed Improvement Components

Table 5: ZONE-1: Infrastructure Details

Sl. No	Locations	Road classification	Road Work		Drainage Work	Footpath	Total width of road (including drainage/ footpath and ROW)	Road+ Pavement width	Remarks
			L(m)	W(m)	L(m)	L(m)	M	M	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
A1	Kunzang Lam -(Motithang below Azhi Buildi+_ftn1ng)	Secondary	493	7.5	200	493	8.8	7.5	Works are contained in right of way
A2	Below BoD Motithang	Tertiary	133	7	133		7.7	7	
	Resident parking		79	14			15.5	14	
A3	Dungkar Lam	Tertiary	195	6.5	195		8	6.5	
A4	Thongsel Lam – Below Shop No.7 towards RUB Junction	Secondary	205	7.5	205		8.2	7.5	
A5	Deki Lam - Along Changangkha Lhakhang till RKPS junction	Primary	215	9			11	9	
A6	Thori Lam - below City 3 tank road to Renew junction	Primary	445	10.5	445	Legend	11.8	10.5	
A7	Pedzoe Lam i) Renew Junction till National Library junction	Secondary	810	9	810	810	10.3	9	
A8	Below ACC office	Tertiary	213	8	213		8.7	8	
A9	Dasing Lam – along City garage and below DNP office	Tertiary	371	6.5	269		7.2	6.5	
A10	Jangchub Lam- along Kelki school	Secondary	225	8	200		8.7	8	
A11	Phendey Lam - milkbooth till Hotel and behind DRC	Secondary	582	8	300		9.3	8	
A12	From Phuntsho Pelri junction ,Thai Temple till Le Meridian junction	Secondary	552	7.5	270		8.8	7.5	

Sl. No	Locations	Road classification	Road Work		Drainage Work	Footpath	Total width of road (including drainage/ footpath and ROW)	Road+ Pavement width	Remarks
			L(m)	W(m)	L(m)	L(m)	M	M	
A13	Gongdzin Lam – in front of 8eleven till Thromde office	Primary	253	11.6			18	11.6	
A14	Peling Lam (from NLC, RAA, MoE till RMA junction	Secondary	445	8.5	445		9.8	8.5	
	Total for Zone 1		**5216m**		**3685m**	**1303 m**			

Note: *As per the Road Rules and Regulations of The Kingdom of Bhutan 2016 “Thromde administration shall, in coordination with the Department of Human Settlements, by an order prescribe the road right of way in accordance with the structural and local area plans and in the absence of such plans, by a notification, in writing.”

Table 6: ZONE-2: Infrastructure Details

Sl. No	Locations	Road classification	Road Work		Drainage Work	Footpath	Total width of road (including drainage/ footpath and ROW)	Road+ Pavement width	Remarks
			L(m)	W(m)	L(m)	L(m)	M	M	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
B1	Dechencholing gate to samteling gate	Secondary	2300	6.5	50		7	6.5	Works are contained in right of way
B2	Samteling gate to Jungshina bridge	Secondary	400	7.5			8.5	7.5	
B3	Towards court to dzong gate	Primary	800	6.5	800		7.7	6.5	
			500 (road widening)	5					
B4	Chubachu: R1 (Road beside Rapa)	Secondary	300	10			12	10	
B5	R2(Road below BDBL)	Secondary	250	6	250		8	6	

Sl. No	Locations	Road classification	Road Work		Drainage Work	Footpath	Total width of road (including drainage/ footpath and ROW)	Road+ Pavement width	Remarks
			L(m)	W(m)	L(m)	L(m)	M	M	
B6	R3(Road above JLPS & BPC)	Secondary	598	6	200	200	7	6	
B7	R4(Road branch)	Secondary	282	10			12	10	
B8	R5(Road joining towards Tarayana building)	Primary	282	6			7.5	6	
B9	R6(Access road joining front road of MyMart)	Secondary	185	5	185		5.9	5	
B10	Main road below BOB office towards JLPS	Primary	585	14			15	14	
	Vegetable market area:	Secondary	300	5	300	300	5.9	5	
B11	R1(Behind vegetable market)		100	10			11.5	10	
B12	R2(Road behind vegetable market branch)	Secondary	100	5			5.9	5	
B13	R3(Road towards vegetable market)	Secondary	144	6	144	144	6.9	6	
B14	R4(Road towards vegetable market)	Secondary	143	6			7.2	6	
B15	R5 (Road towards changlam from vegetable market):	Primary	145	6			7.5	6	
	Parking		120	5.5			7	5.5	
Total for zone II			**7534**		**1929**	**644**			

Table 7: ZONE-3: Infrastructure Details

Sl. No	Locations	Road classification	Road Work		Drainage Work	Footpath	Total width of road (including drainage/ footpath)**	Road+ Pavement width	Remarks
			L(m)	W(m)	L(m)	L(m)	M	M	
(2)		(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
C1	Rabten Lam (from Norling Building till Druk School)	Primary	1980	8	483	427	10.6	8	Works are contained in right of way
C2	Fly-over bridge till Luntenzampa	Primary	1350	8	213.4		9.6	8	
C3	Link road from junction above Chorten till National Commission for women & children signboard	Access	410.5	6	225		6.9	6	
C4	Link road from ring road till Road junction near changzamthog School	Access	360	6	165		6.9	6	
C5	Link road near Chhundu Sawmill till Ring road	Secondary	300	7.2	160		8.8	7.2	
C6	Road above BBPL showroom	Access	215.3	5.5	76	90	8.2	5.5	
C7	Link road from Ring road (below Mani dungkor) till Junction near FCB Go Down	Secondary	387	7	181	250	9.7	7	
C8	By-pass road at Changzamthog till Junction near Cypress tree	Access	175	6	80		6.9	6	

Sl. No	Locations	Road classification	Road Work		Drainage Work	Footpath	Total width of road (including drainage/ footpath)**	Road+ Pavement width	Remarks
			L(m)	W(m)	L(m)	L(m)	M	M	
(2)		(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
C9	Link Road above chhundu Saw Mill connecting towards medical deport	Access	351.9	6.5	100		7.1	6.5	
C10	Kachey- Rabten Lam	Access	855	4.5	500		5.1	4.5	
C11	Road toward DAHE office	Access	90	5	30		5.6	5	
	Footpath at Changdhedaphu					600			
C12	Roads at Changghedaphu	Access	350	3.5	350		4.4	3.5	
C13	Straight road near by election office (rigid pavement)	Primary	400	8			9	8	
C14	Changbandu road	Primary	500	5			7.5	5	
Total for zone III			**7725**		**2571**	**1367**			

Table 8: Zone 4: Infrastructure Details

Sl. No	Locations	Road classification	Road Work		Drainage Work	Footpath	Total width of works (including drainage/ footpath)	Road Pavement width**	Remarks
			L(m)	W(m)	L(m)	L(m)	M	M	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Olakha									
D1	In front of Election office	Primary	165	6.5	920	1516	9	6.5	Works are contained in right of way
D2	Road below bridge	Secondary	370	8			9	8	
D3	Road below bridge 2	Secondary	300	5			6	5	
D4	Road in front of shearee square till election office junction	Primary	820	6.6			9.5	6.6	
D5	4th road from top	Access	320	4.5			5	4.5	
D6	4th road from top 2	Access	150	8			8.5	8	
D7	Road from express way till old high way	Secondary	685	9			11.5	9	
D8	2nd road	Secondary	300	5			6	5	
D9	Road connecting old highway	Secondary	640	6.5			7	6.5	
Babesa									
D10	Road from IT Park joining old highway	Primary	465	7.5	200		8	7.5	Works are contained in right of way
D11	Road in Babesa lap	Secondary	950	9	120		11.5	9	
D12	Road from old highway through Nabirongchu bridge	Primary	842	6.5			7.5	6.5	
D13	Above old high way	Secondary	606	4			4.5	4	
D14	Above old high way 2	Secondary	45	4.5			5	4.5	
D15	Road attached with expressway	Secondary	532	5.5			8	5.5	
	Simtokha								
D16	Road A1	Primary	335.1	7			9	7	Works are

Sl. No	Locations	Road classification	Road Work		Drainage Work	Footpath	Total width of works (including drainage/ footpath)	Road Pavement width**	Remarks
			L(m)	W(m)	L(m)	L(m)	M	M	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Road A2	Primary	481.5	5			7.5	5	contained in right of way
	Road A3	Primary	252.1	10			12.5	10	
	Road A4	Primary	78.4	6			8.5	6	
D17	Road B1	Primary	220	5			7.5	5	
	Road B2	Primary	458.9	5			7.5	5	
	Road B3	Primary	303.5	5			7.5	5	
	Road B4	Primary	104.2	6			8.5	6	
	Road B5	Primary	396.7	10			12.5	10	
D18	Road C1	Primary	264.4	8			10.5	8	
	Road C2	Primary	444.6	7			9.5	7	
	Road C3	Primary	399.3	8			10.5	8	
	Road C4	Primary	94.7	7.5			10	7.5	
	Road C5	Primary	232.6	8			10.5	8	
D19	Road D	Primary	155	6			8.5	6	
D20	Remaining work in Olakha		40	1.7	40				
Total			**12517**		**960**	**1516**			
Road Widening Section									
17	YHSS junction till Semtokha Mani Dungkhor	Primary	3,540	12	1.51		10	12	

23. Field investigations were conducted with the concerned engineers Safeguards Specialists to ascertain the extent of works required under each lot. In addition to the need for road repairs, inadequate drainage was observed to be the major issue in zone 1. People faced problems on account of clogged or damaged drains and there is also a lack of drainage in some areas. As a result not only the rain water but also the waste water from buildings flows out on to the streets thereby damaging the road. Similarly some of the stretches of the foot paths also need repairs and in some areas new foot paths need to be constructed.

24. Under zone 2, the roads and the drains in Chubachu and the vegetable market areas need major renovation works. There are storm drains that do not have cover in some portions which pose risk to pedestrians. Most of the drains behind the vegetable market are clogged and non- functional. All the roads identified need resurfacing works in in spot sections

25. There are fourteen road stretches listed under zone 3 to be undertaken by this project. These sections require immediate repair and resurfacing. The Hebi Lam road above saw mill does not have any drain and whatever water flows on the road is collected there. The only out flow from the road is to a private plot below the road. So a proper drain and road repair has been a need for the people living in the area. The other road stretches (most of them) need drain repairs and most of the drains have drinking water pipes laid in the drains which clog the drains thereby forcing the drain water onto the roads. This is a common issue across all project sites in zones 1, 2 and 3.

26. Under zone 4 there are roads listed under Babesa area, Simtokha area and Olakha Local area plans (LAPs or housing areas). The six road stretches under Babesa area all need resurfacing but do not require no major drain repairs or foot paths. Under the Semtokha area, though only road resurfacing work has been listed and no drain works listed yet in the two roads stretches (Tshalu Lam-second road parallel to Expressway, Simtokha-Babesa road Third road parallel to Expressway) need some drain works to be incorporated. The present situation is that there are foot paths on both sides of the road which are higher in elevation than the road level. As such the rain water does not have access to the drain thereby collecting on the road and ultimately damaging the roads. Some provisions for the rain water to flow into drains need to be constructed. Similarly in the Olakha area, major resurfacing works is needed to be carried out. Like in the Semtokha area here also there needs to be provisions for the rain water on the road to flow into the drains.


Thimphu
YHS Parking
SEMTOKH
Semtokha
Changbangdu
© 2016 Google
Image © 2016 CNES / Astrium
Google earth
2006
Imagery Date: 12/19/2014 27°27'04.46" N 89°39'05.13" E elev 7615 ft eye alt 23140 ft

27. The 3.54 km road widening stretch from the YHSS junction till the Semtokha Mani Dungkhor used to be the old highway when the express way was not there. All vehicles plying to other Dzongkhags (districts) used this road then. With the construction of the express way, the volume of traffic on this road stretch has reduced as much of the traffic is being diverted to the express way. However, vehicles plying to and from the eastern, central and three western Dzongkhags of Wangdue, Punakha and Gasa use this road. Vehicles plying to and from Sarpang, Dagana and Tsirang Dzongkhags also mostly ply on this road stretch. The road stretch is being widened to make it 10 meters (m) wide improve traffic flows along this stretch. This will not increase the number of lanes, but ensure that there is sufficient space for one vehicle each to pass simultaneously in each direction. Map 12 (above) depicts the geographical location of this road stretch. None of the portions along the stretch will affect private lands. As such no compensation or IR issues are foreseen.

D. Construction Approach and Materials

28. Proposed Road resurfacing: Altogether there are 81 stretches of various urban roads that have been planned to be undertaken in the project. In addition, the improvement of parking spaces will also follow the same construction methodologies. The resurfacing works will primarily consist of:

(i) Scarifying metallic (water bound) road surface disposal of rubbish within 50 m and consolidation of aggregate.
(ii) Applying tack coat at .75 kilograms (kg) bitumen per square meters of road surface.
(iii) Providing and laying Asphalt/Bituminous concrete to required degree of compaction based on the job mixture design approved by the supervising engineer using asphalt plant, paver, steel roller, tyre roller etc. as per material gradation and aggregate quantity specified, 40 millimeters (mm) thick.
(iv) Providing and Laying Wet mix macadam graded based course to required degree of compaction with proper formation of cross fall by using well graded crushed aggregate premixed with OMG using suitable mixture mortar grader as per material gradation and a aggregates quality specified.

29. Following are the typical drawings proposed for the project:

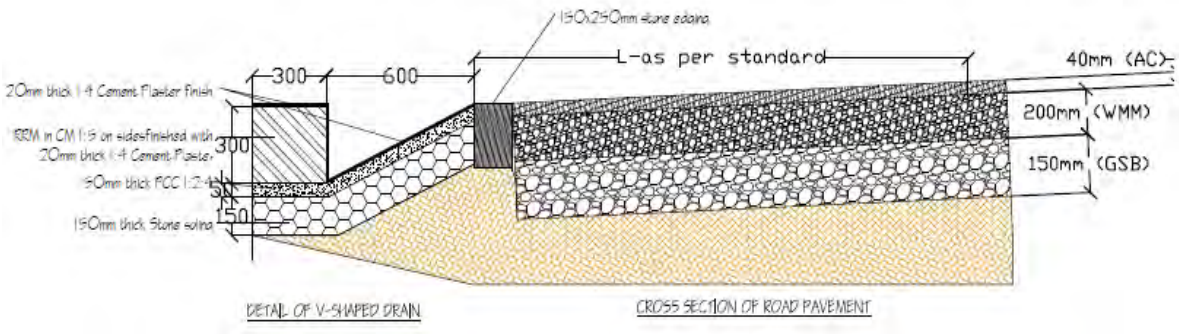

Figure 1: Typical Road Section

1. Design of drains and footpaths

30. Specifications: The drains will be constructed as follows:

(i) Construction of Lined V Shaped drain 600 X 300 with 50 mm thick Plain Cement Concrete (PCC) 1:2:4, 150mm thick stone soling, Random Rubble Masonry (RRM) in CM 1:5 on sides, finished with 20mm thick 1:4 cement plaster including excavation, leveling and disposal of surplus earth within 50 m

(ii) Constructing random rubble masonry open surface drain in cement mortar 1:6 including earth work in excavation, 100 mm thick concrete base 1:5:10, 40 mm aggregate 25 mm thick cement concrete 1:2:4, 12 mm aggregate for filling haunches, including 20 mm cement plaster with a floating coat of neat cement, disposal of surplus earth depth.

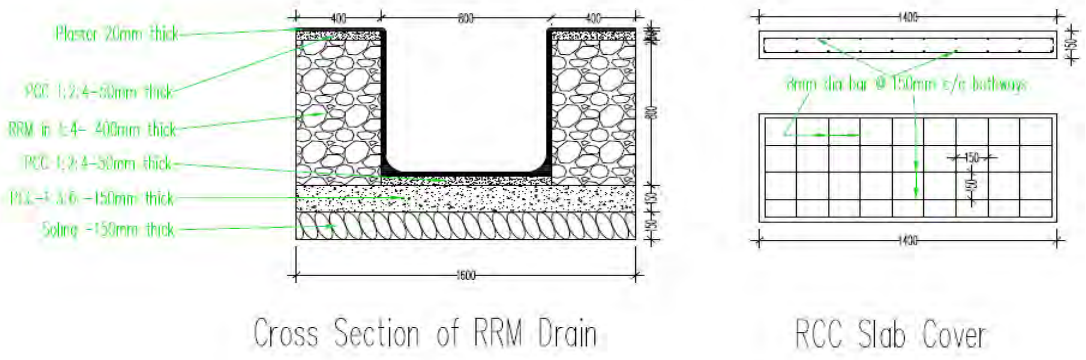

Figure 2: Typical Section of U-shaped Drain along old Highway

Zone II:

31. The footpaths will be constructed as follows:

(i) Earth work in excavation over areas, depth >300 mm, width >1.5 m, area >10 m^2 on plan, including disposal of excavated earth within any lead and lift & disposed soil to be neatly dressed.

(ii) Providing and laying in position plain cement concrete excluding the cost of centering and shuttering - All work up to plinth level1:3:6 (1 cement : 3 sand : 6 graded crushed rock 20 mm nominal size).

(iii) Providing and laying Hand packed stone filling or soling with stones.

(iv) P/L 60 mm thick hydraulic pressed Interlocking blocks in floorings laid on prepared bedding with cement mortar 1:6 (excluding the cost of bedding).

(v) Providing and fixing at or near ground level pre-cast cement concrete in kerbs, edgings etc. as per approval pattern and setting in position with cement mortar 1:3 (1 cement: 3 sand) cost of required formwork and finishing smooth with 6 mm thick cement plaster on exposed surface complete - 1:2:4 (1 cement : 2 sand : 4 graded crushed rock 20 mm nominal size).

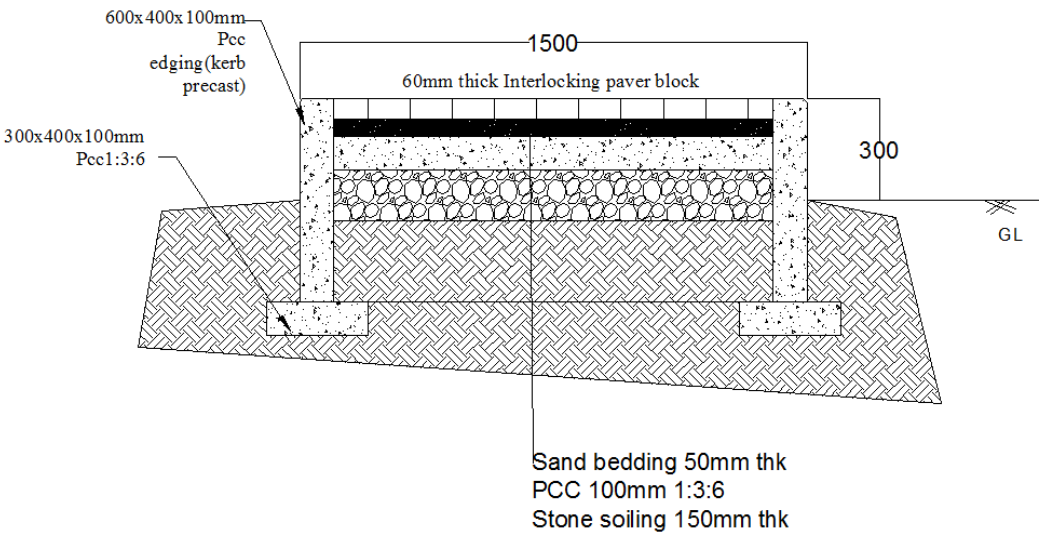

Figure 3: Typical Section of Footpath in zone II

Zone III:

32. The footpaths will be constructed as follows:

(i) Demolishing cement concrete 1:3:6 & richer, including disposal of materials within 50m lead.
(ii) Earth work in excavation over areas, depth >300 mm, width >1.5 m, area >10 m^2 on plan, including disposal of excavated earth within any lead and lift & disposed soil to be neatly dressed.
(iii) Providing and laying Hand packed stone filling or soling with stones.
(iv) Providing & laying sand bedding, including watering, ramming, dressing.
(v) Providing and laying 60 mm thick interlocking Paver Block (Concrete Block) smooth finish, Exterior Designer Tiles for Footpath.
(vi) Providing and laying in position plain cement concrete excluding the cost of centering and shuttering - All work up to plinth level-1:3:6 (1 cement : 3 sand : 6 graded crushed rock 20 mm nominal size)-1:3:6 (1 cement : 3 sand : 6 graded crushed rock 20 mm nominal size).
(vii) Providing and fixing at or near ground level pre-cast cement concrete.
(viii) in kerbs, edgings etc. as per approval pattern and setting in position with cement mortar 1:3 (1 cement : 3 sand) cost of required formwork and finishing smooth with 6 mm thick cement plaster on exposed surface complete - 1:2:4 (1 cement : 2 sand 4 graded crushed rock 20 mm nominal size).

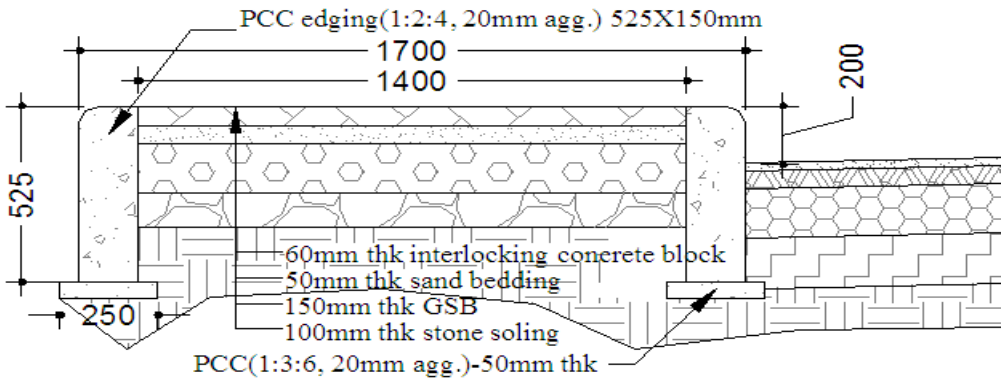

Figure 4: Typical Section of Footpath in zone III

33. **Construction materials: Bitumen/Asphalt Materials:** The Thromde is in the process of identifying the source of the asphalt concrete and bituminous materials required for the re-surfacing works and the same would be made known to the bidders during the bidding process. This would eliminate the requirement of setting up of the hot mix plants which would have environmental issues.

34. **Other materials: Sand/Gravel/Boulders:** There are designated and government approved sources/quarries/processing plants for materials such as boulders (near Dawakha & Damchu about 30-40 km from project sites), aggregates (Namseling and Jemina about 10-20km from project site) and sand (Natural Resource Development Corporation Ltd site at Wangdue about 60km from the project site). Regular tests are carried out at these sources and test certificates are available. All materials that are to be used in the project will require the test certification before their use during the actual construction.

E. Project Cost and Implementation Schedule

35. The estimated cost for all sub-projects is $4.26 million including design and supervision costs. Construction activities for all sub-projects are scheduled to commence by October 2016 and works are expected to be completed by December 2019.

F. Project Cost

36. The project is estimated to cost about $4.26 million which will be provided as a grant by the ADB.

Table 9 : Abstract of Total Project Cost

Sl no.	Description	Road classification	Length (km)	Estimated cost (Nu millions)
1	Road work (Zone I-IV)	Primary	14.57	82,786,637.41
		Secondary	9.17	59,782,428
		Tertiary	0.91	3,734,724
		Access Road	3.58	14,767,214

Sub-total (A)		**28.23**[9]	**161,071,003**
2	Parking (sqm)	5266	5,607,536
3	Drainage (km)	9.15	21,724,192
4	Footpath (km)	4.83	14,479,605
5	Road Marking		760,008
6	Service Pipes		603,642
Sub-total (B)			**43,174,983**
5	Road widening between Semtokha Mani Dungkhor and YHSS junction		**52,748,407**
Sub- total (C)			
Grand total (A+B+C)			**256,994,394**
In USD (Million)			**3.82**
D	Capacity Building		0.07
E	Contingencies		0.37
F	Staff Training/Workshops/Seminars/ Study Tours		0.07
G	Taxes and Duties		0.85
Total (A+B+C+D+E)			**5.11**

G. Construction Packaging and Implementation Schedule.

37. The proposed Project will be implemented in two civil works packages through the international competitive bidding (ICB) method of Procurement. Package 1 includes four lots of road improvement works and package 2 will be for the road widening works. Currently the project is at preparation stage and detailed designs for Package 1 have been completed and works for this Package 1 are expected to be tendered out by Q4 2016. The proposed implementation schedule for the various packages is presented in Table 10 below.

[9] The length of each road segment may vary for several reasons, including changes in the design in response to assessed damages, which could worsen over time, and other uncertainties.

Table 10: Implementation Schedule

PROJECT IMPLEMENTATION PLAN																										
ACITIVITIES	2016							2017												2018-19						
	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	.....	.....
Project Concept Paper		x																								
SRM			x																							
Loan negotiations			x																							
Board circulation				x																						
Board approval				x																						
Package 1 (Lot1/Zone I)																										
Tendering			x	x																						
Bid Evaluation & Award				x	x	←														→						
Construction Works						18months Construction Period																				
D/L Period																								D/L Period (3 yrs)		
Package 1 (Lot2/Zone II)																										
Tendering			x	x																						
Bid Evaluation & Award				x	x	←														→						
Construction Works						18months Construction Period																				
D/L Period																								D/L Period (3 yrs)		
Package 1 (Lot3/Zone III)																										
Tendering			x	x																						
Bid Evaluation & Award				x	x	←														→						
Construction Works						18months Construction Period																				
D/L Period																								D/L Period (3 yrs)		
Package 1 (Lot4/Zone IV)																										
Tendering			x	x																						
Bid Evaluation & Award				x	x	←														→						
Construction Works						18months Construction Period																				
D/L Period																								D/L Period (3 yrs)		
Package 2 Improvement of Urban Road infrastructure Semtokha Mani Dungkhor -YHS junction																										
Tendering					x	x																				
Bid Evaluation & Award						x	x	←												→						
Construction Works								18months Construction Period																		
D/L Period																									D/L Period (3 yrs)	
Staff Training/Workshops/Seminars/Study Tours																										
Batch #1								x																		
Batch #2																x										
Batch #3																					x					
Submission of PCR																										
Closing of the Project																										

IV. BASELINE ENVIRONMENTAL STATUS

A. Physical Environment

1. Topography

38. Bhutan is a landlocked and entirely mountainous country bordered by China in the north, the Indian states of Assam and West Bengal in the south, Sikkim in the west and Arunachal Pradesh in the east. The country has three geographical zones ranging from an altitude of 150 m in the south to over 7,000 m on the northern border. The southern zone with below 2,000 m has low forest hills and dense tropical forests with a hot and humid climate. The central zone lies between 2,000 m and 3,500 m with a semi-tropical climate. The northern zone lies from east to west between 6,800 m and 7,400 m and is part of the eastern Himalayas.

39. The topography of Thimphu District, where the project is located is mostly hilly with occasional steeper slopes and mountainous sections. Thimphu city, the capital of Bhutan covers an area of 2,232 square kilometres (km^2). It falls within the section of north – south running ranges. The capital city of Thimphu, which occupies an area of 26 km^2 is situated in the Wang Chhu river valley. The city is built mostly on the relatively flat valley floor, with some limited development on the steep valley sides. Restrictions are imposed on further development of the valley sides. Elevations range from 2,200 masl to 2,400 msl approximately.

4. Meteorology and Climate

40. Bhutan experiences four seasons: spring (March-May), summer (June-August), autumn (September-November) and winter (October-February). Annual rainfall is concentrated in the monsoon season from June to September. The autumn months of September to November bring shorter days and cooler evenings. Thimphu city experiences a warm, temperate climate under the influence of the southwest monsoon climate

41. In Bhutan temperatures vary between 10°C in winter to 40°C in summer. Thimphu experiences warm subtropical climatic conditions and all four seasons with a heavy monsoon rain for about three months starting from June. June. Analysis of data from 2010 to 2013 (table 11 below) from meteorological station in Thimphu shows a trend of rising mean summer temperatures and lowering winter temperatures. However, due to the short time-series data on temperature, it is difficult to quantify if this is indeed a trend or not.

Table 11: Average Monthly Temperature (Degree Centigrade), Thimphu (2010-2013)

Month/ Temperature	2010 Average	2011 Average	2012 Average	2013 Average
January	7.70	6.70	6.10	5.80
February	9.40	9.45	9.15	9.25
March	13.30	11.70	11.90	13.25
April	16.20	14.60	17.45	14.80
May	17.40	17.70	18.20	18.65
June	20.65	20.40	20.95	21.45
July	21.30	20.75	22.20	21.85
August	21.45	20.90	21.65	21.25
September	19.95	19.10	20.45	20.30
October	16.10	15.70	14.90	16.00
November	12.70	10.85	10.80	10.85
December	8.25	8.75	8.70	7.75
Annual	184.40	176.60	15.20	15.1

Source: Statistical Yearbook of Bhutan, NSB

42. A summary of total daily rainfall in Thimphu city (1996 to 2013) is given in Table 6. Given the rainfall pattern over the region of the Project, it is important that season be considered in planning the implementation of the improvement program. In order to avoid runoff and protect the works earthworks, major construction works should be planned during the dry season (October to March) particularly for areas susceptible to flooding and landslides and for works near rivers.

Table 12: Summary Thimphu Rainfall data (mm)

Year	Jan-March	April-June	July-Sept	Oct-Dec
1996	0.00	0.00	1997.00	76.50
1997	76.50	204.90	412.80	65.30
1998	56.30	105.70	416.30	9.00
1999	21.80	224.30	367.80	108.40
2000	20.60	171.00	258.80	11.80
2001	0.00	324.20	391.00	63.30
2002	68.60	182.30	564.30	24.20

Year	Jan-March	April-June	July-Sept	Oct-Dec
2003	67.50	209.00	405.30	99.40
2004	34.40	184.20	275.90	48.30
2005	31.50	84.30	229.20	115.90
2006	15.80	121.70	340.90	31.20
2007	50.00	89.90	253.00	19.40
2008	33.50	175.50	336.00	48.30
2009	1.00	192.40	254.30	113.90
2010	16.40	192.20	341.40	34.20
2011	39.20	163.30	341.90	27.20
2012	35.50	113.20	404.00	12.00
2013	48.60	227.20	238.10	95.20

Source: Meteorology Section, Hydrological Meteorological Services Division, Department of Energy, MTI, Thimphu, Bhutan.

5. Geology, and Soils

43. Bhutan covers two broad geological zones, the Lesser Himalayan belt along the southern and south-eastern border and the Tethyan belt further north. The Lesser Himalayan formation includes a wide range of sedimentary and low-grade metamorphic rocks, including argillites and metargillites, sandstones, quartzites, limestone, dolomite, and gypsum. The Tethyan formation mainly includes stronger gneisses that account for more than 70% of the country's bedrock and schist and marble, affording a relatively high degree of stability compared to other locations in the Himalayas. Chhukha district is in the Lesser Himalayan belt with tectonically active sedimentary and meta-sedimentary rocks, gneiss, schist, quartzite, and limestone.

44. Thimphu district falls in the Tethyan belt and bedrock comprises mainly gneiss and Tethyan metasediments, schists, quartzite and limestone. The valley floor on which the city is situated bears soil with a high content of alluvium which has been deposited over time by the Wang Chhu River.

6. Seismicity

45. Bhutan is prone to a number of natural hazards due to fragile geological conditions, steep sloping terrain, great elevation differences, variable climatic conditions and active tectonic processes taking place in the Himalayas.

46. There is no detailed seismic micro-zonation of the country. However, since the north-eastern parts of India (next to Bhutan) fall under seismic zone V (seismically most active), it can reasonably be assumed that Bhutan is contiguous with this zone and either in seismic zone IV or V. Hence, there is a threat of a significant earthquake.

7. Hydrology and drainage:

47. Thimphu valley has steep hills sloping down towards the valley and amalgamating into Wangchu river. The valley slopes from north towards south with appreciable slope. It receives moderate rainfall and drainage issues become pertinent and especially so when lots of modern constructions of roads and buildings have come up in the recent past thereby make the surface

drain requirements even more pressing. In order to mitigate the drainage problems appropriate drains will be constructed at identified road stretches.

8. Surface Water

48. Bhutan has four major river basins, namely the Amo Chu (Toorsa), the Wang Chu (Raidak), the Punatshang Chu (Sunkosh) and the Drangme Chu (Manas). All these river systems are either directly or indirectly fed by permanent or seasonal snows, glaciers or high altitude lakes at their sources and surface runoff water from the monsoon rainfall. The subalpine lakes above 3,000 masl constitute valuable high altitude wetland ecosystems in Bhutan but these are far from Thimphu. They are also valued for the diverse habitat provided and the willow, rhododendron bushes and juniper forests.

49. The Wang Chhu River which flows through Thimphu is the principal river of the Wang Chhu basin, one of the four principal river basins in the country. The river flow varies from a low of 3 to 5 m^3/s in January/February, to around 135 m^3/s in some years in the months of August/ September. The river is relatively clean in comparison to other rivers in Himalayan towns but does contain significant levels of pollutants and pathogens. Two tributaries near the southern part of the city, the Olarong Chhu and the Nabirong Chhu, are similarly fast flowing and relatively clean. Waste from the city is not a significant source of contaminants. Surface water quality monitoring data for Thimphu recorded during March 2015 and November 2015 is provided in Tables 13 and 14 below:

Table 13: Surface water quality monitoring data for Thimphu (November 2015 Data)

S/N	Location	GPS Location		Water Quality Parameters				
		Latitude	Longitude	pH (units)	Conductivity µS/cm	Do (mg/l)	COD (mg/l)	BOD (mg/l)
1	Chamgangchhu (Olarongchu u/s)	27^0 28'42.5"	89^0 35'43.2"	7.81	19	8.6	0.5	0
2	Olarongchhu d/s (below the bridge)	27^0 26'36"	89^0 39'36.6"	8.35	68	9.01	2	0.9
3	Wangchhu (Tango)	27^0 35' 36.3"	89^0 37'44.1"	8.46	201.6	9.52	0.9	0.3
4	Wangchhu (Pangri zampa)	27^0 32'08.8	89^0 38'56.4"	9.01	167.2	9.01	0.6	0.13
5	Wangchhu (below cremation ground)	27^0 29' 39.7"	89^0 38'14.1"	8.5	149.1	9.03	0.5	0.2
6	Wangchhu (u/s of STP)	27^0 26'19.6"	89^0 39'18.3"	9.01	150	9.05	0.5	0.3
7	Wangchhu m/s (below Debsizampa)	27^0 25' 49.3"	89^0 38'30"	8.25	129	9.05	0.8	0.5
8	Wangchhu d/s (khasadrapchu)	27^0 23'24.5"	89^0 35'14.5"	9.07	145.5	11.19	0.1	0.6

Table 14: Surface water quality monitoring data for Thimphu (March 2015 Data)

S/N	Location	GPS Location		Water Quality Parameters						
		Latitude	Longitude	pH (units)	Conductivity µS/cm	Do (mg/l)	COD (mg/l)	BOD (mg/l)	TP (mg/l)	TN (mg/l)
1	Chamgangchhu (Olarongchu u/s)	27^0 28'42.5"	89^0 35'43.2"	8.36	25.8	8.19	0.5	0	0.06	0.24
2	Olarongchhu d/s (below the bridge)	27^0 26'36"	89^0 39'36.6"	8.56	71.5	8.55	2.5	1.4	2.5	1.35
3	Wangchhu (Tango)	27^0 35' 36.3"	89^0 37'44.1"	8.46	201.6	9.52	0.9	0.3	0.06	0.24
4	Wangchhu (Pangrizampa)	27^0 32'08.8	89^0 38'56.4"	9.01	167.2	9.01	0.6	0.13	2.5	0.24
5	Wangchhu (below cremation ground)	27^0 29' 39.7"	89^0 38'14.1"	9.01	153	10.66	0.8	0.24	0.06	0.24
6	Wangchhu (u/s of STP)	27^0 26'19.6"	89^0 39'18.3"	9.56	164.1	9.51	0.5	0	0.84	0.24
7	Wangchhu m/s (below Debsizampa)	27^0 25' 49.3"	89^0 38'30"	8.49	134.9	9.65	1.1	0.24	0.25	0.24
8	Wangchhu d/s (khasadrapchu)	27^0 23'24.5"	89^0 35'14.5"	8.81	163.3	9.38	2.5	0.13	0.21	0.24

50. The area does not provide any aquatic resources for subsistence or trade, but the streams in the hills provide water for drinking, bathing, and crop irrigation. The rivers are not navigable and transportation is restricted to road transport via roads.

51. There are no major industries in the catchment area of the River Wang Chhu in the Thimphu area. However, the project activities may contribute to increased sediment runoff, which will need to be managed during the construction period.

9. Ground water

52. There is no data available on the groundwater potential. Ground water resources appear to be abundant with springs emerging from basement rocks near the landslide and fluvial deposits. Development of a 0.5 MLD capacity ground water supply scheme through boreholes was completed in 2012 for augmentation of water supply to Changbangdu and lower Changzamtog.

10. Water supply and sanitation

53. Thimphu Thromde is responsible for providing safe drinking water to the residents within the city. Piped water supply is available to all parts of the main city and some of the sub-urban areas. Average daily demand is 22.10 MLD with an estimated household consumption is 900 l/d based on metered water consumption.

54. The Thimphu Thromde water supply system consists of four water treatment plants located at Motithang, Jungshina, Dechencholing and Chamgang with combined production capacity of about 20.9 MLD. Water is supplied to the core city areas and few areas in the immediate vicinity in the north (i.e. Hejo & Langjophakha) and to the Changjiji Housing colony in the south. Development of a 0.5 MLD capacity ground water supply scheme through boreholes was completed in 2012 for augmentation of water supply to Changbangdu and lower Changzamtog.

55. An independent water supply scheme was built by Thimphu Thromde in 2005/06 at Chamgang which is presently providing water supply to Olakha Auto Workshop, Lungtenphu, Olakha & Jalue areas in the South. A separate water source has also been developed recently for the new workshop at Olakha.

56. The water supply in the four local area plans (LAPs) in the south namely Changbangdu, Lungtenphu, Semtokha & Babesa is covered through the 6.50 MLD capacity water treatment plant at Megaypang funded by the ADB. Similarly, water supply to Dechencholing LAP in the north is provided through the 1.40 MLD capacity water treatment plant funded by the World Bank.

57. The combined capacity of water supply is now around 22 MLD while the water demand forecast for 2030 stands at about 36 MLD thereby resulting in a deficit of 14 MLD by 2030. With a view to meet the expected deficit of about 14MLD within the design horizon, Thimphu Thromde is intending to build a new Water treatment plant at Taba through financing being provided by World Bank[10].

58. There is no organized drainage system in Thimphu. The whole drainage system has evolved as per the construction sequence of different areas as and when they were taken up. The present system is combined system, conveying both storm water runoff and household wastewater. The drains are usually lined open drains with a rectangular or trapezoidal profile. The implementation of drainage infrastructure has not been governed by city-wide drainage plans and universal standards. The present drains therefore are of different designs and lack conformity to an overall plan. Because the total connecting areas often are not known the sizes of the main and collector drains are constructed by “rule of thumb”. These general conditions have amplified the adverse effects related to disrepair and the requirement for maintenance

11. Air Quality

59. Air pollution in Bhutan is a recent phenomenon and can be attributed to rapid urbanization and industrial developments. Diesel vehicles with poor engine maintenance and poor quality of fuel are also major sources for the urban air pollution.

[10] (Draft) Environment Assessment for “Central Water Supply Scheme” at Dodena under Thimphu Thromde.

60. Air quality monitoring was not undertaken for the Project. In addition to the high population and larger traffic in comparison to other towns of Bhutan, Thimphu city is a high elevation valley, surrounded by mountains which do not let pollutants in the air disperse off easily to nearby areas or regions. By observation in general, air quality near the project sites is acceptable but there are large amounts of dust being re-suspended from the roads surface. However dust levels are not high enough to obscure vision significantly. Ambient air quality concerns are mainly limited to Thimphu Municipal area. Improvements in the road surface will lead to a substantial reduction of dust levels.

61. In the project area the gaseous pollutants of carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide (NO_2) from traffic are well dispersed in the open terrain and there is potentially adequate dispersion in the wide open areas in the town to keep concentrations within the NEC standards (Appendix C). The combination of high elevation and low temperature levels especially during the winter cause the city to be covered by a blanket of cold air which prevents any pollutants in the air to rise and disperse off into the atmosphere

62. Ambient air quality monitoring is not being done in project area. However, a regular ambient air quality testing regime for Thimphu is being established by the NEC and the data available from NEC is shown in tabular form below. As per the Environmental Standards, 2010 of NEC, the yearly average PM10 should be a maximum of 60 and the data available (presented below) shows that the yearly average is below the threshold value. However, higher values are observed for specific days, primarily during winter which could be attributed to dry weather, wind effect and volume of construction.

Table 15: PM10 monitoring data in Thimphu

Year	2012	Date	2013	Date	2014	Date	2015	Date
Highest	138	31.12.2012	111.87	31.12.2013	128.39	31.12.2014	238.78	17.12.2015
Lowest	1.37	1.1.2012	0.2	1.1.2013	4.96	1.6.2014	2.36	26.2.2015
Yearly Average	45		39		44		41	

12. Noise

63. Noise levels in Thimphu come primarily from construction activity and traffic. Although there is no specific data on the number of ongoing construction activities in the city the noise issue can mainly be correlated to the building permits that are issued (which gives the owner to undertake the construction activities). Following figure shows the details of building permits issued year wise.[11]

[11] Source: Thimphu Thromde.

64. Noise from construction activities is also a concern in most of the areas around the proposed works. However, noise levels are generally within acceptable limits for the public and there were no complaints about current noise levels from the public during consultation. The criterion for site noise for a mixed area in Bhutan is Leq65dB (A) (day) and Leq 55dB (A) (night, Appendix C). The World Bank standard applies an ambient criterion of Leq 55dB (A) for residential areas, hospitals and schools which is equivalent to the NEC standard for sensitive areas. Where the background exceeds the ambient standards the criterion is background +3dB (A). Based on observation in the settlements and towns where traffic runs throughout the day, the criterion of Leq55dB(A) for residential, school and hospital sensitive receivers is potentially exceeded at some times. As the criteria are potentially exceeded at some times of the day it is recommended that in order to make a consistent assessment for all locations the existing criterion of background +3dB(A) will be applied in the assessment for both daytime and night time. This will meet the requirements of ADB SPS.

Table 16: World Bank Group's EHS Noise Level Guidelines

Table 1.7.1- Noise Level Guidelines[54]		
	One Hour L_{Aeq} (dBA)	
Receptor	Daytime 07:00 - 22:00	Nighttime 22:00 - 07:00
Residential; institutional; educational[55]	55	45
Industrial; commercial	70	70

54= Guidelines values are for noise levels measured out of doors. Source: Guidelines for Community Noise, World Health Organization (WHO), 1999.

B. Biological Environment

1. Forestry

65. Bhutan has a wide variety of plants, many of which have conservation significance. There are three main eco-floristic zones: the alpine zone; the temperate zone and the sub-

tropical zone. Towns and cities currently occupy only a small portion of the total land area. Trees and shrubs are planted extensively within urban areas around the country and are an important part of the urban environment. The City of Thimphu is surrounded by coniferous forests dominated by Blue pine. A number of species of ornamental plants and trees have been planted along streets, the river and in open spaces, adding significantly to the city's appeal. It is a policy of the Thimphu City Corporation (TCC) to not allow any type of construction along the boundaries of rivers and streams in order to have a green area buffering all water bodies.

66. Forests are managed according to four types: government owned national forest, community forest, sokshing (registered to an individual person or household) and private tree plantations. Government forests are managed by the Department of Forests while community forest is managed by the village or a community. The sokshing (woodlots) and private forests are owned and managed by individuals, households and local communities. No forest management units (FMUs) are within the project area of influence. The project site is in the urban area where there are no forested areas. However, there are few trees the vicinity of the project.

67. The local forests are managed by the Department of Forests and Park Services (DOFPS) and there is a Divisional Forestry Office for Thimphu Dzongkhag which looks after the forests in and round the urban areas as well. This Division looks after any cutting/ felling of trees both in the rural and urban areas. After repeated site visits it is concluded that there will be no felling of trees because of the project.

2. Fauna and Flora

68. The project area falls completely within Thimphu Thromde or City limit. Hence there are no threatened or endangered floras or fauna in the project area. The project will not in any way affect or impact, disturb or affect any species as the project area falls within the urban limits. Also there are no wild animals within the project areas.

3. Land Use.

69. Due to rapid urbanization, more than half of Bhutan's population will reside in urban centers by 2020. There is a rapid influx of rural migrants, resulting in an urgent need for improved urban services. The urban centers such as Thimphu will be major drivers of economic growth; reliant on good infrastructure. Owing to the thriving trade and related development in Thimphu, the town has experienced rapid population growth and urbanization and now suffers overcrowding, traffic congestion and unhygienic conditions. Thimphu Thromde is strategically located along the Wangchu River. Starting from Dechencholing in the north to Babesa in the south the Wangchu River meanders through human settlements in a north to south direction. The flat land on both sides of the river is dotted with concrete buildings which are emerging at a rapid pace. Very little of the urban land under the Thimphu Thromde is under cultivation and patches of vacant land is under government reserve forest which construction activities cannot take place. Thimphu City's urbanization and growth is highly influenced by in-migration and planned expansion has taken place towards the north and south of the city. Expansion is constrained by limited quality infrastructure as well as lack of suitable flat land.

4. Demographic characteristics and public health

70. Thimphu is the largest city in Bhutan. It has an estimated population of 116,012[12] in 2015 (15.3% of national population), is the densest urban inhabitation in Bhutan with a population density of around 3,453 persons per square km[13]. The Thimphu Structure Plan acknowledges the high population growth rate for Thimphu and is based on projection for the year 2025 (162,327 persons) based on the carrying capacity of the city. Male to female ratio of Thimphu population in 2000 was 42,465: 36,720; in 2010, it had been estimated to be of almost equal proportion at 46,742 for female and 46,490 for male, respectively.

71. The public health condition is more or less similar throughout the Thimphu Thromde. Most Bhutanese have access to potable drinking water in the urban areas (98%) and basic sanitation (91%). Widespread health concerns include diarrhea and pneumonia. Diabetes, alcohol-related liver disease and cancer are also prevalent. Less widespread are malaria and tuberculosis. Among children under age 5, skin infections; conjunctivitis and intestinal worms are significant concerns.

72. Bhutan launched its telephone Health Help Centre in 2011 which has proved successful and provides emergency response and the Healthcare Helpline which dispenses medical advice. Both services are accessible through land and mobile phones. Emergency responses are served by ambulances in Thimphu.

5. Cultural and historical sites

73. The Bhutan Himalayas straddle the watershed of the Brahmaputra river basin. The river is regarded with religious reverence and faithfully believed as the blessed water of LhaTshangpa or Goddess Tshangpa, thus called as Tshangpo in its head water sources of the Autonomous Region of the Tibetan Plateau. Bhutan has four major rivers. Thimphu City has a number of Monasteries and two Dzongs (Tashi Chhodzong and Semtokha Dzong). Monastries within the urban limits Changgangkha Lhakhang, Memorial Chorten, vegetable market Zangdo Pelri, Lhakhang next to Thai Temple, Lhakhang below Changzamtog School, Manidungkhor at Changzamtog and Semtokha, Buddha Statue at Kuenselphodrang and some small chortens (stupas)scattered around the Thromde. No sites of cultural or historic importance are located in the project vicinity, i.e within 20 m of the project sites. It may also be noted that as per the existing setback rules of the urban areas, sufficient setbacks have been maintained so as not to conflict with any possible extensions within the right of way.

6. Housing and basic services

74. The housing concentration is more in the core area (along Norzin Lam), Motithang and Changzamtog. However over the years a similar trend of housing concentration is emerging at the other urban locations of Olakha, Semthokha, Babesa, Dechencholing, Taba, Langjuphakha and Hejo/Pamtso areas.

75. The City has one Thromde office also serving as community center and 4 public parks. Supplying the daily needs of the population are several supermarkets and small stores, one weekend market, and numerous meat markets and small markets. The health and medical

[12] Ministry of Works and Human Settlement (MOWHS). 2016. *Formulation of National Human Settlement Strategy Analysis Report* (22 February 2016, CRISIL).
[13] Based on the 2010 population estimate.

infrastructures include the Jigme Dorji Wangchuk National Referral Hospitals, the Indian Military Training Team (IMTRAT) Hospital, The National Indigenous Hospital, The DANTAK Hospital, Army Hospital, 3 BHUs. There is also 1 crematorium in the city. There are 32 schools of in four categories viz..Higher Secondary Schools, Middle Secondary Schools, Lower Secondary Schools and Primary Schools. Besides, there are 7 Early Child Care & Development Centres and 13 Non-Formal Education Centres. There are also 2 schools for traditional arts and crafts and 1 integrated technical institute. For higher education, there is one university located just outside the district municipal boundary.

76. Residential properties are located at distances mandated by the Thromde leaving enough space between the roads and the private properties. The front facades of the houses are generally set back from the sites outside the area of direct impact. No land acquisition will be required or relocation of properties or resettlement does not seem to be a significant issue based on observation from site visits. There are a few instances of approach structures which are encroaching the right of way, which will need to be managed properly during the construction stage through proper environmental management planning.

77. **Power Supply** is handled by the Bhutan Power Corporation. Power supply to the core area is provided through underground cable and the same trend is being followed and expanded in the other LAPs and zones. Every building under the Thromde is connected to electricity. It is mandatory for buildings under construction to complete the construction works and apply for a certificate for occupancy before the building can be rented out to tenants.

78. **Telecommunications.** The fixed line telephony system in Thimphu is mainly distributed to the underground (UG) and aerial copper cables (AE). Further it has been augmented using underground fibre cable and the total capacity of the UG and AE are more than 20,000 lines. Bhutan Telecom is sole provider of fixed line services. The primary or the UG network is laid underground. The capacity of the network is sufficient to meet the demand and is met as and when applied by the consumers. The future proposals include provision of UG secondary network in every building and replacement of the existing aerial network by underground network. Apparently, the Bhutan Telecom which is the sole agency dealing with telecommunication (besides Tashi Cell which also handles mobile network) does not have a Master Plan of telephone network in Thimphu but their plan has been prepared based on the annual growth or demand.

79. **Underground utilites:** Faulty underground utility pipes and cables, in particular so-called water supply “spaghetti connections” can be seen at many places. It is common practice to route water supply pipes inside drains, which not only leads to clogging of drains but also poses serious risks of contamination to household water supply. Thimphu thromde must address this issue during the pre-construction phase. In several sections throughout the city,

V. ANTICIPATED ENVIRONMENTAL IMPACTS & MITIGATION MEASURES

80. The main physical impacts will come in the construction phase from activities including (i) resurfacing/ repairing of 32.99 km of urban road, (ii) resurfacing/ repairing of 4,239 m^2 of parking space; (iii) construction of 4.83 km of footpaths/ pavements along some of the urban roads, (iv) repair and construction of 9.15 km of drainage; and (iv) widening of the 3.54 km of urban road (to 10 m wide) plus median and hard shoulders between YHSS junction and Mani Dungkhor.

81. This section of the IEE identifies nature, extent, and magnitude of likely changes vis-a-vis project activities for all stage of project cycle i.e. preconstruction, construction, and operation. Beneficial impacts are mostly long-term and permanent whereas adverse impacts are localized and temporary in nature and are likely to occur mostly during construction stage.

A. Beneficial Impacts

82. The cumulative beneficial impacts are expected to be high the Thimphu City. Currently, the poor road conditions and associated infrastructure (pavements, drainage, and parking) are causing severe problems of poor traffic flows, dust, water accumulation along the roads etc. Therefore the project will have the following cumulative beneficial impacts:

(i) Easing of traffic congestion inside Thimphu city: Improvement of the these urban roads will result in the reduction in travel time and lower vehicle operating cost i.e. per kilometer vehicle operating cost from the general improvement work and an absolute saving in cost due to reduction in fuel consumption for the existing traffic. Improved access and reduced travel times and costs will be major stimuli to economic growth.

(ii) Local employment generation. The immediate benefits of road construction and improvement will come in the form of direct employment opportunities during construction for the local contractors (one package is NCB) and suppliers of raw materials.

(iii) Improved drainage infrastructure along roads. The improved drainage will prevent potential water logging which not only provides unhealthy local environment such as foul smells and mosquito breeding ground and also be the main source of road degradation after all poor drainage is a major source. Improved pedestrian experience as a result of the construction of footpaths. The provision of footpaths provides safety and easy to the commuters and will substantially improve both pedestrian and vehicle safety. The project will include the construction of access infrastructure (eg pedestrian friendly ramps) which is friendly for differently abled people

(iv) Reduction in congestion problems due to the provision of adequate parking spaces.

(v) Allowing of smooth and access to socio-economic resources; leading to better economic output of the country. Improved access and reduced travel times and costs will be major stimuli to economic growth.

(vi) Reduction in travel times and vehicle operating costs. Improvement of the these urban roads will result in the reduction in travel time and lower vehicle operating cost i.e. per kilometre vehicle operating cost from the general improvement work and an absolute saving in cost due to reduction in fuel consumption for the existing traffic.

B. Adverse Impacts

83. This section describes the adverse environmental impacts likely to occur due to this project during pre-construction, construction and operation period. These impacts are not major and appropriate mitigation measures have also been identified to offset these negative impacts. The Environmental Management Plan to manage these impacts is presented in Section VI.

C. Design / Pre-Construction Phase Impacts and Mitigation Measures

1. Detailed Design – issues and mitigation measures being adopted

84. The key risk involved during this stage would be inadequate designs which do not confirm to national environmental standards and/or building codes. Detailed design and specifications for the proposed road-works in Thimphu have already been completed by Thimphu Thromde. These include typical sections, construction methodologies, and preparation of detailed material specifications for the road repair works, footpaths and drains. These typical design and details have been approved by the Ministry of Works and Human Settlements (MOWHS) as part of the standard designs and specifications and are compliant with the Specifications for Building & Roads, Ministry of Works and Human Settlements.

85. The detailed designs for the road widening section are currently being prepared and these shall be done in accordance with Specifications for Building & Roads, Ministry of Works and Human Settlements. There is one 200m section of the road widening stretch where there is not enough space available to achieve the desired 10m road width, due to the presence of a slope adjacent to the ROW with properties located above. In order not to disturb the existing precipice/ slope adjacent to the right of way, this particular road section will be extended to cover the existing drain in order to get the desired 10m width. The road extension over the drainage channel will be designed to ensure adequate load bearing capacity to ensure that vehicles passing over this section do not damage the road overhang. The hydrology for this specific road section will be designed such that the water is able to enter the drainage channel which will be covered by the road section.

2. Tree Felling

86. From the site visit surveys it has been confirmed tree felling is not at all anticipated for the project including the road widening section along the YHSS – Manidungkhor. In case, tree feeling in particular locations will be required during the implementation period, these impacts will be mitigated through mitigation measures which are outlined under the ‘Construction phase impacts’ outlined in this chapter.

3. Underground utilities

87. It is essential to rectify faulty underground utilities before road resurfacing and repairs. As mentioned in the previous section there are several instances where water supply pipes for individual households are being routed through open drainage channels and many “spaghetti connections” can be seen at several places. During the pre-construction phase these should be rectified to the extent possible before the road resurfacing and repair works, by means of, for example, installation of “common ducts” for pipe crossing, etc.

4. Environmental capacity development

88. Environment Division under Thimphu Thromde is involved in management and operation of city’s solid waste collection and disposal; sewerage treatment; water treatment and supply; and maintenance of drainage and footpaths. However, it is not involved in monitoring and supervision of any new projects; since it is the responsibility of the Engineering Division. Both the Divisions lack expertise and experience in carrying out the environmental compliance monitoring of the projects. Under the current project, personnel of Engineering Division who are

part of the Project Management Unit (PMU); will be provided on the job training on environmental monitoring and reporting.

D. Construction Phase and Mitigation Measures

89. This section discusses the potential environmental impacts of the proposed during the construction stage. Where impacts are significant enough to exceed accepted environmental standards, mitigation measures are proposed in order to reduce residual impact to acceptable levels and achieve the expected outcomes of the project. The environmental assessments are carried out in line with Safeguard policies of ADB and the regulations of the government. In this IEE project construction supervision is assumed to be carried out by Project Implementation Unit (PIU) and Environment Division of the Thimphu Thromde

90. All other impacts are temporary and localized in nature limited to construction period. The following subsections describe anticipated impacts and its mitigation measures on all aspects of physical, ecological and socio-cultural environment during construction and operation stage of the projects.

1. Orientation of contractor

91. Lack of adequately trained contractors will impact the implementation of the environmental mitigation measures during the construction period. The Environment Unit of the Thimphu Thromde shall conduct awareness training for the contractors and the site agents and workers on implementation of construction mitigation measures in the Project Environmental Management Plan (EMP), Site Environmental Management Plans (SEMPs) and any additional mitigation measures that may be required during the construction phase.

2. Habitat alteration and fragmentation

92. Disruption of terrestrial and aquatic habitats can occur during the construction period. Construction activities along a road alignment may adversely affect wildlife, depending on the characteristics of existing vegetation, topographic features, and waterways. The project lies completely within the built-up area of Thimphu Thromde, where these is no presence of wildlife habitats in natural condition. The road works are sited within the right of way of existing urban roads. The works are not located close to any forested areas or critical habitat zones with high biodiversity value or with the presence of IUCN listed red listed species[14]. The works will not create barriers to wildlife movement, or visual and auditory disturbances due to the presence of machinery, construction workers and equipment.

3. Hydrology, Drainage and Storm water management

93. **Drainage and Hydrology.** Construction or widening of sealed roads increases the amount of permeable surface area, which increases the rate of surface water runoff. High storm water flow rates can lead to erosion and flooding. In addition, sediment erosion from construction activities and storm water runoff may increase turbidity of surface waters. The project includes the construction of drains along critical road sections in order to control the peak run off flows and mitigate flooding. In order to avoid erosion and runoff, all excavation and earth works will be will be carried out dry season (November to April). Erosion will be prevented

[14] The IUCN Red List of Threatened Species (also known as the IUCN Red List or Red Data List), founded in 1964, is the world's most comprehensive inventory of the global conservation status of biological species.

by protecting cut slope with temporary or permanent drainage as soon as practicable after cutting. In order to preserve the constructed slopes and other works and embankments from soil erosion and runoff, high embankments, i.e. 2m high and above, will be considered for protection by constructing stone pitching or a riprap across the embankment immediately after the works are completed. This practice will also be applied along cross-drainage structures where embankments are more susceptible to erosion by water runoff. Significant oil and grease are not expected to be generated and therefore the use of water separators and treatment procedures has not been included in the scope of this IEE report.

94. **Road Paving.** Road paving (including pothole repairs) will be undertaken during the dry weather to prevent runoff of asphalt or cement materials. Proper staging techniques will be employed to reduce the spillage of paving materials (asphalt etc.) during the repair of potholes and worn pavements. This will include covering the inlets of the road drainage channels and manholes during the paving operations; using erosion and sediment control measures (g. drip pans and absorbent material on paving ,machines) in order to limit leaks and spills of paving materials and fluids. Other measures to control storm water runoffs include: (i) limiting the amount of water used for dust control and using sweeping practices rather than washing; (ii) collecting and returning swept material to aggregate base or disposing as solid waste, as per Bhutanese local standards and IFC's General EHS Guidelines; (ii) containing cleaning products and contaminated asphalt residues, scraping be fire cleaning and conducting cleaning activities away from surface water features or drainage channels (natural or constructed)

4. Tree Felling

95. If at all tree felling will be required during the course of project implementation, then it will be done with approval from Department of Forest and Park Services (DOFPS). Upon approval from the DOFPS, Thimphu Thromde will carry out tree felling in accordance with procedure set forth in Forest and Nature Conservation Rules (2006). Only the necessary trees that are marked by the DOFPS will be felled. The economically valuable timbers will be handed to the Natural Resource Development Corporation limited (NRDCL). Thimphu Thromde in consultation with DOFPS will carry out compensatory plantation. Depending on the availability of vacant or barren government land, compensatory ratio of minimum of 1:1 will be followed if area designated is small and for large areas a ratio of 1:4 will be followed.

5. Materials exploitation and management of quarry and borrow areas

96. Road maintenance, repair and new construction in the urban areas will continue to cause large demands for construction materials. Some of the major impacts arising from the road improvement projects like borrowing and quarrying will be minimal since as all aggregates will be procured from existing licensed quarries in the vicinity of the Thimphu region. As there are no identified quarries within the project area, construction materials particularly stone will be sourced from the nearby government approved, existing and operational quarries. Sand will be procured from the Natural Resource Development Corporation Ltd. (NRDCL) which is the only authorized supplier of sand in the Thimphu region. There will be no directive of quarrying in the project area. No mitigation measures will be prescribed for the already operational quarries. Implementation of mitigation measures and subsequent monitoring is carried out by agencies like Dzongkhag/District authorities, Department of Geology and Mines (DGM); and National Environment Commission (NEC). Only mitigation measure that is applicable directly is maintenance of material transport vehicle; covering of materials; and spraying of water along haulage route. Water spraying can be done by tanker at least twice a day or as often as required based on visual observation of dust emissions. Water can be sourced from Wangchu River.

6. Waste.

97. This includes attention to spoil disposal, general construction waste management, hazardous materials and hazardous waste disposal. Construction Impacts pertaining to these and mitigation measures have been described below. It is likely that the construction activities will be carried out only during dry season from late October till May**.**

7. Spoil Disposal

98. There will be limited excavation requirement and hence there will be limited spoil generation. The assessment indicates the possibility of achieving 100% balance cut and fill for road works. Therefore, identifying separate disposal sites was found unnecessary. If any excess spoil is generated during the project implementation, the PIU will consult Thimphu Thromde and identify the proper disposal site. Disposal area once complete will be re-vegetated using the local or native species.

8. General Construction Waste Management

99. Solid waste will be generated during construction. Minimal earth moving works are anticipated which will generate rock and soil materials. Solid waste generation during construction works may include road resurfacing waste (removal of old road surface material), litter, dumped waste, vegetal waste (fallen branches etc.), animal carcasses and sediment or sludge from the drains. Uncontrolled waste disposal will contaminate soil and water bodies, thereby harming the environment. Mitigation measures will seek to reduce, recycle and reuse waste as far as practicable. The contractors will ensure implementation of following measures:

(i) In principle, the waste generation will be minimized at source.
(ii) Waste products will be segregated, recycled and reused whenever possible. Examples would include recycling road resurfacing waste as aggregate (e.g. Reclaimed asphalt pavement or reclaimed concrete material) or as a base
(iii) Any recyclable waste which cannot be reused during construction will be sold to licensed scrap dealers.
(iv) Organic waste such as plant materials will be composted.
(v) Collect animal carcasses in a timely manner and disposing through prompt burial or other environmentally safe methods;
(vi) Residual non-hazardous waste will be disposed off in the municipal landfill.

(vii) Construction/workers' camps (if any) will be provided with sufficient refuse bins.
(viii) Burning of construction and domestic wastes will be prohibited.
(ix) Sludge removed from storm water drains will be classified as hazardous or non-hazardous waste and disposed in designated landfill sites in accordance with national regulations.

100. Disposal of solid wastes into flood ways, wetland, rivers, other watercourses, farmland, forest and associated places of worship or other culturally sensitive areas or areas where a livelihood is derived canals, agricultural fields and public areas will be prohibited. Solid waste will only be disposed in Thimphu Thromde's designated areas such as landfills.

9. Hazardous materials and hazardous waste disposal

101. Use of hazardous substances such as oils and lubricants can cause significant impacts if uncontrolled or if waste is not disposed correctly. Oils and lubricants discharged to woodland can kill the roots and destroy the trees. Mitigation measures will seek to control access to and the use of hazardous substances such as oils and lubricants and control waste disposal. Contractor will carry out following measures to minimize the impacts:

(i) Use of hazardous material should be minimized or restricted.
(ii) Oil and lubricants will be safely stored (away from sensitive receptors, residential areas and construction camps if any). Secondary containment around fuel storage area will be ensured
(iii) Controls and standard operating procedures will be developed for the use of fuels and other hazardous substances to prevent spills, accidents and pilferage.
(iv) Hydrocarbon, toxic material and explosives (if required) will be stored in adequately protected sites as per the Explosive and Hazardous Rules of the government to prevent soil and water contamination.
(v) Equipment/vehicle maintenance and refueling areas will be confined to areas in construction sites designed to contain spilled lubricants and fuels. Such areas will be provided with drainage leading to an oil-water separator that will be regularly skimmed of oil and maintained to ensure efficiency.
(vi) Fuel and other hazardous substances will be stored in areas provided with roof, impervious flooring and bund/containment wall to protect these from the elements and to readily contain spilled fuel/lubricant.
(vii) Hazardous wastes (oil, used batteries, fuel drums) will be segregated, labeled and safely stored. The spent oil and batteries will be sold to recycling dealers.
(viii) Hazardous materials will be stored away from water bodies and above flood level.
(ix) Cleanup operation using readily available absorbent such as sawdust will be carried out immediately during accidental spillage of hazardous waste
(x) All areas intended for storage of hazardous materials will be quarantined and provided with adequate facilities to combat emergency situations complying with all the applicable statutory stipulation.

102. During construction, the contractor will ensure the proper disposal of spoil and other waste.

10. Asphalt, hot mix plant, rock crushing and bitumen supply

103. The Thimphu Thromde plans to procure ready to lay asphalt and bitumen products that will be required for the works through approved source whose production factory will be located at an approved location and with the Environment Clearance from NEC. Therefore, undue impact due to asphalt, hot mix plant, rock crushing and bitumen supply is not envisaged.

11. Noise

104. Traffic noise will be generated by vehicle engines (including construction vehicles), existing traffic, and emission of exhaust. Use of heavy machinery and equipment (earth-moving and excavation equipment, construction supply vehicles), particularly for the road widening works is likely to generate noise. Traffic noise can be a significant source of nuisance for the

institutions and communities located close to the project sites[15]. There are no health facilities, religious sites (temples and religious places), scheduled or unscheduled historical, archaeological, paleontological, or architectural sites near the construction sites. However, construction works will be on settlements, along schools, and areas with small-scale businesses. The sensitive receptors are the general population in these areas. The Impacts are negative, short-term, and reversible by mitigation measures. The construction contractor will be required to:

(i) Plan activities in consultation with PIU so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance;
(ii) Require horns not be used unless it is necessary to warn other road users or animals of the vehicle‘s approach;
(iii) Ensure that noise levels do not exceed 5% of the NEC daytime noise level standards for residential and institutional areas (i.e. Leq65dB(A)+ 55dB(A). Works will not be conducted during the night time.
(iv) If noise level exceed the stipulated limits then design and implement noise control measures such as the installation of temporary stationary noise barriers along the right of ways, use of equipment with good quality mufflers in working order, arranging heavy construction vehicles .as noise barriers and increasing the distance between noisy equipment and noise-sensitive areas,.
(v) Refraining from undertaking construction near schools during school hours or during examination periods,
(vi) Inform the residents and institutions of the construction schedule in their vicinity and the likelihood of excess noise during these periods, specifying the anticipated periods during which these impacts will affect them.

12. Air Quality

105. Air emissions will typically be related to dust generation during construction (primarily from Earthworks and rock crushing) and exhaust from vehicles. In order to prevent fugitive dust emissions and fumes from construction vehicles the following precautionary measures will be undertaken by the contractors: (i) water sprinkling or spraying using tanker will be done twice a day or as often as required based on visual observation of dust emissions in order to reduce dust generation; (ii) water can be sourced from Thimphuchu, Olarongchu, Wangchhu; (iii) Fuel efficient and well-maintained haulage trucks will be employed to minimize exhaust emissions. Regular maintenance will be carried out; (iv) all vehicles and machinery used for construction should have valid pollution control certificates (emission tests certificates); (v) Vehicles transporting soil, sand and other loose and fine construction materials shall not be overloaded and will be covered with tarpaulin sheets to reduce the release of dust and avoid impacts from dust. Speed limits of such vehicles within the works site and on unpaved edge areas of the Project road will be established and agreed with the PMU; and (vi) paving any unpaved approach roads where possible

13. Blasting and vibration

106. No blasting will be carried out as the road construction works are contained with road right of ways and within the built up area of Thimphu Thromde. In the event, the blasting is required due to unavoidable circumstances then only non-explosive chemical based blasting

[15] Traffic noise levels are reduced by distance, terrain, vegetation and natural and man-made obstacles.

material will be used for rock breaking. This will not generate any noise or vibration; hence there will be no impact on humans and the structures.

14. Water Quality

107. In order to prevent water contamination the following precautionary measures will be undertaken by the contractors:

(i) Lubricants will be stored in containers /dedicated enclosures with a sealed floor >50 m from water bodies.
(ii) Solid waste from construction activities will not be thrown in rivers.
(iii) Construction storage/stockpiles will be provided with bunds to prevent silted run-off.
(iv) Stockpiled materials will be covered to reduce run-off.
(v) Washing of machinery and vehicles in surface waters will be prohibited

15. Construction camps and canteen facilities

108. As the project includes small localized works in several spot sections of the city. it is anticipated that local labour will be used and the provision of construction camps may not be necessary. In case, construction camps will be required to be set up during project implementation, these will not be sited too close to the local communities in order to avoidunwanted interference in the communities way of living. The competition for use of local resources (such as food supply, water supply and fuel wood) will increase; disadvantaging the local community. Therefore, construction camps will be placed in a proper location in consultation with PIU. Adequate drinking water supply, basic food items, and cooking fuel (such as kerosene) will be provided to ward off competition on local resources. For maintenance of proper health and hygiene; pit latrines and garbage cans will provided. Fishing, hunting and illegal tree felling will be totally prohibited. After completion of construction, the abandoned campsite will be cleaned and restored to the original state. If a campsite is a government barren land then contractor will carry out compensatory plantation with suitable local or native plant species.

16. Sanitation and Disease Prevention

109. Concentration of labourers during construction will likely result in spread of communicable diseases such as HIV/AIDS, STDs, malaria and Tuberculosis (TB). Unhygienic living condition without proper sanitation facilities will increase potential harmful waterborne diseases. In order prevent health related impacts the contractor will implement following measures:

(i) Measures to prevent proliferation of mosquitoes will be implemented (e.g., provision of insecticide treated mosquito nets to workers, installation of proper drainage to avoid formation of stagnant water, etc.).
(ii) Standing water will not be allowed to accumulate in the temporary drainage facilities or along the roadside, to prevent proliferation of mosquitoes.
(iii) Temporary and permanent drainage facilities will be designed to facilitate the rapid removal of surface water from all areas and prevent the accumulation of surface water ponds.

(iv) HIV-AIDS awareness or education will be implemented in line with social programmes and plans for the Project and HIV/AIDS awareness and prevention program shall be implemented in line with plans from the social work stream.
(v) Sanitation facilities such as construction of pit latrines and solid waste collection disposal will be implemented.
(vi) Health checkup or screening of the imported labourers will be carried out as per the existing practices to stop spread of TB.

17. Occupational Health and Safety

110. Worker occupational health and safety is generally governed Labour and Employment Act of Bhutan 2007. Construction works will generally result in accidents and injuries or even demise of the workers if no health and safety measures are followed. General Rules and Regulations on Occupational Health and Safety (OHS) in Construction, Manufacturing, Mining and Service Industries 2006 will be applied for occupation safety. Occupational Health and Safety involves mitigating three sub- groups of hazards, namely physical hazards, chemical hazards and noise. Mitigation measures to be implemented by contractors to ensure health and safety of workers within each of these subcategories is provided below.

a. Physical Hazards

111. Road construction and maintenance personnel can be exposed to a variety of physical hazards, principally from operating machinery, exposure to weather elements, working in confined spaces, contact with overhead power lines, falls from machinery and risk of falling objects. In order to mitigate these impacts the contractor will implement the following:

(i) Routing of traffic to alternative roads where possible
(ii) Closure of lanes and diversion of traffic to the remaining lanes if the road is wide enough (eg. rerouting the all traffic to one side of the road)
(iii) Where worker exposure to traffic cannot be completely eliminated, use of protective barriers to shield workers from traffic vehicles, or installation of channeling devices (e.g. traffic cones and barrels) to delineate work zone
(iv) Design of work space to eliminate or decrease blind spots
(v) Reduction of maximum vehicle speeds in working zones
(vi) Workers shall be provided with appropriate personnel safety equipment such as safety boots, helmets, gloves, protective clothes, dust mask, goggles, and ear protection at no cost to the workers. The PIU in collaboration with environment division will orient the contractors to proper occupational health and safety measures who in turn will impart the same to the workers during the time of work implementation. This will include construction camp rules and site agents/foremen will follow up with toolbox talks on a regular basis. Workforce training for all workers starting on site will include safety and environmental hygiene. When operating power tools at height, workers should use a second (backup) safety strap. Fencing on all areas of excavation greater than 1m deep and sides of temporary works shall be observed. Contractor will at all-time keep the first aid kit at the construction sites.
(vii) Contractor will be responsible for evacuation injured person to the nearest medical center and bear all the medical expenses
(viii) Reversing signals shall be installed on all construction vehicles and plants.
(ix) The contractors will instruct and induct all workers in health and safety matters (induction course)

b. Chemical Hazards

112. Chemical hazards during road construction, operations and maintenance activities are associated with exposure to dust, exhaust emissions from heavy equipment and motor vehicles and diesel fuel used as a release and cleaning agent for paving equipment. In order to mitigate these impacts the contractor will implement the following:

(i) Use of correct asphalt product for each specific application, and ensuring application at the correct temperature to reduce fuming of bitumen during normal handling;
(ii) Maintenance of work vehicles and machinery to minimize air emissions;
(iii) Reduction of engine idling time in construction sites
(iv) Use of extenders or other means to direct diesel exhaust away from the operator
(v) Use of protective clothing when working with cutbacks (a mixture of asphalt and solvents for the repair of pavement), diesel fuel or other solvents
(vi) Avoiding the use of lead containing paint and using appropriate respiratory protection when removing paints (including those containing lead in older installations) or when cutting galvanized steel

18. Noise

113. Construction personnel may be potentially exposed to extremely high levels of noise from heavy equipment operation and from working in proximity to vehicular traffic. As most of these noise sources cannot be prevented, the contractor should undertake control measures including the use of personal hearing protection by exposed personnel, implementation of work rotation programs to reduce cumulative impacts and installing suitable mufflers on engine exhausts and compressor component.

19. Public Health and Safety

114. Public safety, particularly of pedestrians and children can be threatened by the excavation of the trenches for side drain construction. Construction sites near to settlements will be adequately provided safety barriers and proper signage and provision of safe corridors for pedestrians must be provided along the road alignments. Safe crossing areas should be designated and marked for pedestrians and cyclists. Barriers must be installed to deter pedestrians' access to construction site, except at designated crossing points. Traffic calming devices and speed controls must be installed and maintained at pedestrian crossing sites. Traffic must be adequately regulated (eg. through signs, signals, markings) near critical pedestrian zones or bikeways. Construction activities will be timed and provision for safe passage of school children and elderly will be provided. At sensitive locations pedestrian movement will be guided by the security personnel. Excavated trenches/ditches and freshly cut steep side slopes will be clearly marked and fenced for the safety of passers-by and workers alike. Project or construction vehicles will be briefed on speed limit within sensitive areas such as schools, commercial and residential areas (20 kph). In event of accidents, the contractor will be responsible for immediate evacuation of injured person to the nearest medical center. The contractor shall bear medical and other expenses of the injured person.

20. Traffic Safety and Management

115. Construction activities are likely to cause hindrance in local traffic flow if not properly planned and executed. Contractor in consultation with PMU; local authorities (such as traffic

police, Road Safety & Transport Authority and Thimphu Thromde) and local communities will come up with traffic management plan during construction. Work hours and traffic windows will be decided and implemented accordingly. Traffic flow during the rush hours (school and office opening and closing time) will be kept open so that there is minimal disruption to traffic during peak rush hours. Assistance of traffic police will be sought for implementing the traffic management plan.

21. Emergency Preparedness

116. Emergency situations most commonly associated with road operations include accidents involving single or multiple vehicles, pedestrians, and / or the release of oil or hazardous materials. Contractors should prepare an emergency preparedness and response plan in coordination with the local community and local emergency responders to provide timely first aid response in the event of accidents and hazardous materials response in the event of spills.

22. Archaeological and cultural artifacts

117. There are no archaeological or cultural sites within Project area and limited excavation is involved only in the Semtokha Mani Dungkhor and YHSS junction stretch. For this stretch excavation will occur in and around existing ROWs as such there will be minimum risk of such impacts. However, in the event, any chance finds are sited, then following measures will be applied:

(i) Should any potential items be located, the PMU and Thimphu Thromde will immediately be contacted and work will be temporarily stopped in that area.
(ii) If the site supervisor determines that the item is of potential significance, an officer from the Ministry of Home and Cultural Affairs (MOHCA) will be invited to inspect the site and work will be stopped. Until MOHCA has responded to this invitation, work will not re-commence in this location until agreement has been reached between MOHCA, PMU and Thimphu thromde as to any required mitigation measures, which may include excavation.

23. Access Structures

118. There are two locations where access structure (steps and ramps) of buildings adjacent to the roads are encroaching the road right of way. The contractor will ensure that temporary access to the road for these properties is provided during construction activities and that suitable access provisions (located outside of the ROW) are re-instated after the completion of works. In addition, several project sites are located near residential, government and community areas and property owners in such areas may experience temporary disruption to road access. The contractor will provide temporary access facilities (like crossing over planks at alternate, nearby locations) to ensure that the access to the road is maintained at all times.

E. Operational Phase

119. During the operational phase of the Project the Thimphu Thromde will maintain the road. The Thimphu Thromde is recommended to implement environmental monitoring programs to address all activities identified in this section. Monitoring frequency should be sufficient to provide representative data for the parameter being monitored. The Environmental Division of the Thimphu Thromde will undertake this monitoring employing record keeping procedures and through the using adequate equipment. Monitoring equipment should be analyzed and reviewed at regular intervals and compared with operating standards so that necessary corrective actions

can be taken. The Thimphu Thromde should refer to the guidance on sampling and analytical methods for emissions and effluents as per the guidance provided in General EHS Guidelines of the IFC. The Thimphu Thromde should seek complementarities in data recording and monitoring with the Road Safety and Traffic Authority of the Ministry of Information and Communications. Under the grant, the engineers from the Thimphu Thromde's Road Division will be provided training for roads operation and maintenance including environmental monitoring. The operation stage impacts with adequate mitigation measures are provided below.

1. Noise

120. The main noise source in most areas is traffic noise and in order for the existing background to be exceeded by +55dB(A) the existing traffic would have to be more than doubled[16]. A 55dB (A) increase in noise levels is considered to be imperceptible. The road improvement works are not expected to substantially increase traffic volumes as they will not lead to traffic diversion from alternate routes. Even the road widening works will not be adding an additional lane to the road stretch. The traffic is likely to follow its natural growth trajectory as a result of growth in vehicles in the city (which is about 5-7% per year). Considering this situation, it is highly unlikely that the natural traffic increase will lead to a doubling of traffic in the near-medium term future. Therefore, the noise level increase is unlikely to be perceptible in the next couple of years. Further, the improvement of the project roads is within existing and established corridors, keeping vehicles away from sensitive receivers. At this stage it is difficult to see that any residences or commercial premises or schools will still be adversely affected by increased noise levels exceeding the assessment criteria.

2. Gaseous emissions

121. The road works are restricted to improvement works and do not include the construction of brand new roads which will substantially increase the volume of traffic through traffic being diverted to the new road. The project is hence not expected to give rise to significant point source air emissions or effluents. Vehicle emissions (gaseous) as indicated concentration of oxides of nitrogen will be the main air pollution sources during operation. There will be few other sources of emissions near the project roads. These can be contained by ensuring that vehicles undertake mandatory pollution checking and maintenance procedures.

3. Particulate Emissions

122. The improvement of condition of project roads as a result of resurfacing can be expected to air pollution from dust. Dust from the existing road will be reduced since the asphalt surface is less dust producing than an unpaved/pot holed road. Vehicle emissions (particulate contamination) such as dust and fumes will also be the main sources of air pollution sources during the operation phase. However toxic residues from vehicle emissions near the project roads are unlikely to accumulate or create significant impacts under the local conditions. The road surfaces will be maintained properly by the Thimphu Thromde to ensure smooth traffic flow and reduction of vehicular emission. Therefore the project is believed to be sustainable in terms of gaseous and particulate emissions and no operational mitigation measures are required.

[16] Institute of Environmental Assessment. Guidelines for the Environmental Assessment of Road traffic. Lincoln. UK.

4. Soil Erosion and water pollution

123. Since the works involves mainly resurfacing of the existing roads no soil erosion will be associated with these resurfacing works. The Semtokha Mani Dungkhor and YHSS junction which involves additional widening, will include the construction of retaining/breast walls wherever applicable, and minimum soil excavation is anticipated along this stretch. As a result of which no soil erosion problems are anticipated.

124. Measures will also be taken during the operational phase to ensure that the frequency of maintenance is increased and that storm drains along the roads are periodically cleared to maintain clear drainage to allow rapid dispersal of storm water flow. During the operation phase, regular inspection and maintenance of permanent erosion and runoff control features will be undertaken. Maintaining the drains in good working condition will be key to mitigating any adverse environmental impacts related to erosion and flooding. An adequate system of monitoring, reporting and maintenance will be developed.

5. Driving Conditions and Community Safety

125. The rehabilitation of the roads is likely to increase the vehicle speeds on the roads. Increases in traffic flows indicate additional future traffic should be moderate and unlikely to create major community safety issues. Overall the condition of the road facilities will be enhanced and driving conditions should improve. Improved pedestrian and drainage infrastructure will also enhance pedestrian safety. Routine safety measures, signage and road markings should be introduced to reduce driving risks in accident prone areas and provide enhancements to driving conditions. ADB will also provide further technical assistance through the preparation of a traffic management plan which will help to regulate traffic and enhance pedestrian safety. The training being provided to the Thimphu Thromde officials will also help in this regard by enhancing their capacity for the O&M of the road infrastructure.

126. The Environmental Management Plan (EMP) is presented in Table 17 as a matrix of mitigation and monitoring measures to prevent or minimize the negative environmental impacts of the projects. Any complaints received regarding the implementation of the EMP will be managed through the Grievance Redress Mechanism which is described in Chapter IX.

VI. ENVIRONMENTAL MANAGEMENT PLAN

A. Implementation Arrangements

127. Thimphu Thromde will undertake the detailed designs and preparation of Bidding and Contract document. The construction supervision and environmental monitoring works will also be carried out by PIU, Thimphu Thromde. The bidding and contract document will include the Environmental Management Plan (EMP). Environmental Management cost will be included in Bill of Quantity (BOQ) for effective implementation of environmental mitigation measures. Environmental Clearance will be issued by the MoWHS.

128. To facilitate EMP implementation, during construction the contractors must be prepared during the tendering and pre-construction phase to cooperate with DES, PMU and the local population in the mitigation of impacts. However, experience suggests that contractors may have little impetus or interest in dealing with environmental problems in the absence of performance-related criteria. Therefore, as mentioned above, the contractor will be required to

agree to the implementation of the EMP updated as necessary by the PMU during detailed design phase. The EMP implementation, including the provision of adequate budget for this will be included in the contract conditions. Clearances for payments will include certification from the PMU as to the effective implementation of the EMP and all other mitigation measures specified in the EMP. The completion of implementation of mitigation measures will therefore be linked to payment milestones.

B. Environmental Mitigation

129. The anticipated environmental impacts and mitigation measures discussed in the previous section are presented in Table 17. The table also shows responsibilities and timeframe/schedule for implementation of mitigation measures and monitoring.

130. Table 17 shows that most mitigation activities during pre-construction are to be implemented by the PMU. During construction mitigation measures shall be primarily implemented by the contractors and monitored by PMU on behalf of DES. During operation stage, DES shall undertake environmental mitigation and monitoring requirements specified in the EMP. To ensure implementation of mitigation measures during construction, the EMP shall be included in the tender and contract documents for civil works. Contractors' conformity with environmental contract procedures and specifications shall be regularly monitored by DES with assistance from PMU and results shall be reported semi-annually to ADB. The project design will incorporate the IEE study recommendations. EMP will be made integral part of the bidding contract document. Environmental Mitigation measures will need to be itemized and put in the Bill of Quantities (BOQ).

Table 17: Environment Management Plan & Monitoring Framework

	Impact mitigation						Performance and impact monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures (MM)**	**Responsible for Implementation**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter for monitor**	**Frequency & Verification**	**Responsible to Monitor**	**Monitoring Cost**
DESIGN & PRE-CONSTRUCTION										
1.Design measures	Incorporate design measures in the project design to minimize environmental impacts. Compliance with the government statutory environmental assessment process.	1. Detail design for project conforming to the government's environmental and technical design standards 2. No land acquisition or physical or economic displacement is envisaged 3. Identify potential disposal areas for cut surface spoil materials and to avoid fly-tipping. Conduct consultation with the local authority and local communities in order to obtain their approval for use of land before bidding. 4. Secure necessary environmental clearances 5. Prepare plans to minimize disturbance of vehicular traffic and pedestrians during construction.	PIU	Detailed design phase Preconstruction stage	Project office. Project sites	PIU, Thimphu Thromde through internal resources	Environmental approval for the Project obtained from NEC. Community consultation conducted	Completion of detailed design/prior to start of site works. Ongoing.	DES, MOWHS	MOWHS Budget

	Impact mitigation						Performance and impact monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures (MM)**	**Responsible for Implementation**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter for monitor**	**Frequency & Verification**	**Responsible to Monitor**	**Monitoring Cost**
2. Underground utilities		• Rectify faulty underground utilities before road resurfacing and repairs, for example, installation of "common ducts" for pipe crossing, etc.	PIU	Detailed design phase Preconstruction stage	Project sites	PIU, Thimphu Thromde through internal resources	Common ducts and other measures incorporated	Ongoing during pre-construction phase	DES, MOWHS	MOWHS Budget
3. Environmental capacity development	Develop environmental management capacity of the PIU,TT	• Under the current project, some staff will undergo a short term training/ study course to enhance their capacities in environmental monitoring and O &M of road infrastructure. . .	ADB/ PIU	Initiate during detailed design phase and Pre construction period	Construction Site	PIU Budget	Check at DD Complete training and check before and during construction	Prior to start of site works and throughout construction phase	DES, MOWHS	To be borne by MOWHS
CONSTRUCTION STAGE										
1. Orientation for Contractors, Workers on environmental management.	Contractors & workers trained to implement mitigation measures and better implementation of EMP.	A. PIU will conduct awareness training/orientation for the contractors and their site agents with regard to implementation of mitigation measures in the EMP and any additional mitigation measures that may be required	A. PIU	Before start of site works Upon deployment of workers to project site	Throughout project sites	to be borne by PIU, Thimphu Thromde	Complete check of implementation of items 1 to 2	1. Before start of site works 2. Monthly during construction	DES, MOWHS	To be borne by MOWHS

	Impact mitigation						Performance and impact monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures (MM)**	**Responsible for Implementation**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter for monitor**	**Frequency & Verification**	**Responsible to Monitor**	**Monitoring Cost**
		during the construction (for e.g. in the SEMPs) phase B. Provide HIV-AIDS education and disease prevention awareness talks to the contractor and their site agents								
2.Drainage and Hydrological Impacts including storm water management	To minimize hydrological impacts flooding and excessive runoff	Wangchu River falls within the project area. Construction activities can affect/impact the river water quality due to erosion runoff Contractor will implement following measures to minimize the impacts. A. During construction, the contractor will ensure the proper disposal of spoil and other wastes. Excavated construction spoil will be used for filling during road widening and embankment construction. B. Protection of cut slopes with temporary or permanent	Contractor	Throughout construction phase	Construction Site.	Included in project and bid costs	Check implementation of items 1-13	1 to 3: Daily by PIU	PIU/TT Environmental Officer,	PIU budget

	Impact mitigation						Performance and impact monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures (MM)**	**Responsible for Implementation**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter for monitor**	**Frequency & Verification**	**Responsible to Monitor**	**Monitoring Cost**
		drainage as soon a practicable after cutting C. High embankments (greater than 2m high) to be protected with stone pitching or rip rap across the embankment immediately after the works are completed D. As far as practicable road paving to be conducted in the dry season. E. Covering inlets of road drainage channels and manholes during paving operations F. Using erosion and sediment control measures (e.g.- drip pans) G. limiting the amount of water used for dust control and using sweeping practices rather than washing H. collecting and returning swept material to aggregate base or disposing as solid								

	Impact mitigation						Performance and impact monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures (MM)**	**Responsible for Implementation**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter for monitor**	**Frequency & Verification**	**Responsible to Monitor**	**Monitoring Cost**
		waste, I. Containing cleaning products and contaminated asphalt residues, scraping before cleaning and conducting cleaning activities away from surface water features or drainage channels. J. HHazardous waste such as oil and lubricants (vehicles & machineries) will be properly stored and sent for recycling. K. Solid municipal waste will be disposed off in a municipal landfill. L. Construction of retaining/breast walls wherever applicable, to contain soil erosion								
3. Tree felling	To manage loss of trees in a sustainable way	1. Thimphu Thromde to seek approval of DOFPS 2. Carry out tree felling in accordance with the procedures set forth in Forest and Nature Conservation Rules (2006) 3. Carrying out compensatory	PIU, Thimphu Thromde |(for approvals) and contractor	If necessity for tree felling is identified during the project implementation	Site specific	Cost included in contracts	Approval of DOFPS; Compensatory plantation	As required during construction	DES, MOWHS	MOWHS budget

	Impact mitigation						Performance and impact monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures (MM)**	**Responsible for Implementation**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter for monitor**	**Frequency & Verification**	**Responsible to Monitor**	**Monitoring Cost**
		plantation in consultation with DOFPS. On government land, compensatory ratio of minimum of 1:1 will be followed if area designated is small and for large areas a ratio of 1:4 will be followed.								
Materials exploitation and management of quarry and borrow areas	To minimize adverse environmental impacts of borrowing and quarrying	1. All construction materials, particularly stone to be sourced from nearby government approved, existing and operational quarries. 2. Sand will be procured from the Natural Resource Development Corporation Ltd. (NRDCL) which is the only authorized supplier of sand in the Thimphu regions 3. No direct quarrying in the project area. 4. Maintenance of material transport vehicles; covering of materials; and spraying of water along haulage route. Water spraying can be done by tanker at least twice a day or	Contractor	Ongoing, throughout project implementation	Across all sites	Cost included in the contracts	Monitoring 1-4	Throughout project implementation	PIU, TT, Environmental officer	PIU budget

	Impact mitigation						Performance and impact monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures (MM)**	**Responsible for Implementation**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter for monitor**	**Frequency & Verification**	**Responsible to Monitor**	**Monitoring Cost**
		as often as required based on visual observation of dust emissions. Water can be sourced from Wangchu River.								
WASTE										
a. Spoils	Reduce soil generation	1. Aim to achieve balance cut and fill for road works. 2. Dispose spoil waste in proper designated disposal site 3. Undertake vegetation of disposal area using local/ native species.	Contractor	As and when required based on the construction implementation schedule.	Across all sites as required and final disposal at designated site	Cost included in the contracts	Monitoring 1-3	Throughout project implementation	PIU, TT, Environmental Officer	PIU budget
3.General Construction Waste Disposal	Reduce, reuse and recycle waste and reduce contamination due to poor waste disposal practices	i) In principle, the waste generation will be minimized at source. ii) Waste products will be segregated into bio-degradable and non-biodegradable and disposed in Thimphu Thromde's waste collection system. iii) Recycling to be undertaken as far as possible. Examples would include recycling road resurfacing waste as	Contractor	Throughout construction phase	Project site and waste disposal areas	Cost included in contracts	Check implementation of items 1-11	Bi-weekly. As part of day-to-day project construction	PIU/TT Environmental Officer,	PIU Budgets

	Impact mitigation						Performance and impact monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures (MM)**	**Responsible for Implementation**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter for monitor**	**Frequency & Verification**	**Responsible to Monitor**	**Monitoring Cost**
		aggregate (e.g. Reclaimed asphalt pavement or reclaimed concrete material) or as a base iv) Any recyclable waste which cannot be reused during construction will be sold to licensed scrap dealers. v) Residual non-hazardous waste will be disposed-off in the municipal land fill. vi) Construction/workers camps will be provided with sufficient refuse bins. vii) Organic waste such as plant materials will be composted. viii) Animal carcasses will be collected in a timely manner and disposed through prompt burial or other environmentally safe methods; ix) Burning of construction and domestic wastes will be prohibited.								

	Impact mitigation						Performance and impact monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures (MM)**	**Responsible for Implementation**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter for monitor**	**Frequency & Verification**	**Responsible to Monitor**	**Monitoring Cost**
		x) Disposal of solid wastes into flood ways, wetland, rivers, other watercourses, farmland, forest and associated places of worship or other culturally sensitive areas or areas where a livelihood is derived canals, agricultural fields and public areas will be prohibited. Solid waste will only be disposed in Thimphu Thromde's designated areas such as landfills. xi) Sludge removed from storm water drains will be classified as hazardous or non-hazardous waste and disposed in designated landfill sites in accordance with national regulations.								
4.Use of hazardous substances and hazardous waste disposal	Minimize contamination through proper use, storage and disposal of hazardous	1. Oil and lubricants will be safely stored. Secondary containment around fuel storage area will be ensured. 2. Controls and	Contractor	Throughout construction phase	Project site and waste disposal areas	Cost included in contracts	Check implementation of items 1-9	Bi-weekly As part of day-to-day project construction	PIU/ Thimphu Thromde Environmental Officer,	PIU Budgets

	Impact mitigation						Performance and impact monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures (MM)**	**Responsible for Implementation**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter for monitor**	**Frequency & Verification**	**Responsible to Monitor**	**Monitoring Cost**
	substances	standard operating procedures will be developed for the use of fuels and other hazardous substances to prevent spills, accidents and pilferage. 3. Hydrocarbon, toxic material, and explosives (if required) will be stored in adequately protected sites as per the Explosive and Hazardous Rules of the government to prevent soil and water contamination. 4. Equipment/vehicle maintenance and refueling areas will be confined to areas in construction sites designed to contain spilled lubricants and fuels. Such areas will be provided with drainage leading to an oil-water separator that will be regularly skimmed of oil and						supervision		

	Impact mitigation						Performance and impact monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures (MM)**	**Responsible for Implementation**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter for monitor**	**Frequency & Verification**	**Responsible to Monitor**	**Monitoring Cost**
		maintained to ensure efficiency. 5. Fuel and other hazardous substances will be stored in safe and isolated areas provided with roof, impervious flooring and bund/containment wall to protect these from the spillage. 6. Hazardous wastes (oil, used batteries, fuel drums) will be segregated, labelled and safely stored. The spent oil and batteries will be sold to recycling dealers. 7. Hazardous materials will be stored away from water bodies and above flood level. 8. Clean-up operation using readily available absorbent such as sawdust will be carried out immediately during accidental spillage of hazardous waste. 9. All areas intended for storage of hazardous materials will be quarantines and provided with adequate facilities to combat emergency situations complying with all applicable								

	Impact mitigation						Performance and impact monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures (MM)**	**Responsible for Implementation**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter for monitor**	**Frequency & Verification**	**Responsible to Monitor**	**Monitoring Cost**
		statutory stipulation.								
5.Asphalt hot mix plant, bitumen usage and rock crushing	Avoid air pollution, traffic obstructions and soil contamination	1. Thimphu Thromde to procure ready to lay asphalt and bitumen products from approved source whose production factory will be located in an approved location and with NEC clearance. 2. In case localized asphalt and hot mixing is required follow 2-3: Locate asphalt plant and rock crusher (wherever practical) at least 500m from nearest sensitive receivers (residential areas, schools, hospital, etc.) and rivers and install and maintain dust suppression equipment. 3. Bitumen as well as firewood will not be used as fuel for heating bitumen. Bitumen drums stored in dedicated area not scattered along Project roads and other project facilities.	Contractor, Thimphu Thromde	Throughout construction phase	Project site and waste disposal areas	Cost included in contracts	Check implementation of items 1-7 Monthly monitor Total Standard Particles (TSP) within plant site.	1. Before establishment of facilities 2.-7 : Daily by PIU	PIU/ Thimphu Thromde Environmental Officer,	PIU budget

	Impact mitigation						Performance and impact monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures (MM)**	**Responsible for Implementation**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter for monitor**	**Frequency & Verification**	**Responsible to Monitor**	**Monitoring Cost**
		4. Bitumen will not be allowed to enter drainage system. 5. Bitumen storage and mixing areas shall be protected against spillage. 6. All accidental spills of bitumen or chemicals should be cleaned up immediately by removing the top 2cm of any contaminated soil underneath and disposed of as chemical waste to a site approved by the local authority. 7. Recycle debris generated by dismantling of existing pavement subject to the suitability of the material.								
5. Air quality	To minimize and reduce fugitive dust emissions and fumes from the construction vehicles.	1. Water sprinkling or spraying using tanker will be done twice a day or as often as required based on visual observation in order to reduce dust generation. 2. Water can be sourced from Thimphuchu,	Contractor	Throughout construction phase	Project site and waste disposal areas	Cost included in contracts	Check implementation of items 1-5	Daily during construction	PIU Thimphu Thromde Environmental Officer,	PIU Budgets

	Impact mitigation						Performance and impact monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures (MM)**	**Responsible for Implementation**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter for monitor**	**Frequency & Verification**	**Responsible to Monitor**	**Monitoring Cost**
		Wangchhu and Olarongchu 3. Fuel efficient and well-maintained haulage trucks will be employed to minimize exhaust emissions. Regular maintenance will be carried out. 4. All vehicles and machinery used for construction should have valid pollution control certificates (emission tests certificates) 5. Vehicles transporting soil, sand and other loose and fine construction materials shall not be overloaded and will be covered with tarpaulin sheets to reduce the release of dust and avoid impacts from dust. Speed limits of such vehicles within the works site and on unpaved edge areas of the Project road will be established and agreed with the PMU. 6. Paving any								

	Impact mitigation						Performance and impact monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures (MM)**	**Responsible for Implementation**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter for monitor**	**Frequency & Verification**	**Responsible to Monitor**	**Monitoring Cost**
		unpaved approach roads where possible								
Noise	Minimize nuisance to community due to increased noise levels	1. Plan activities in consultation with PIU so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance; 2. Require horns not be used unless it is necessary to warn other road users or animals of the vehicle's approach; 3. Ensure that noise levels do not exceed 5% of the NEC daytime noise level standards for residential and institutional areas (ie Leq65dB(A)+ 55dB(A). Works will not be conducted during the night time. 4. If noise level exceed the stipulated limits then design and implement noise control measures such as the	Contractor	Throughout construction phase	Project sites, especially around sensitive receptors	Cost included in contracts	Check implementation of items 1-6	Daily during construction	PIU Thimphu Thromde Environmental Officer,	PIU Budgets

	Impact mitigation						Performance and impact monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures (MM)**	**Responsible for Implementation**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter for monitor**	**Frequency & Verification**	**Responsible to Monitor**	**Monitoring Cost**
		installation of temporary stationary noise barriers along the right of ways, use of equipment with good quality mufflers in working order, arranging heavy construction vehicles as noise barriers and increasing the distance between noisy equipment and noise-sensitive areas,. 5. Refraining from undertaking construction near schools during school hours or during examination periods, 6. Inform the residents and institutions of the construction schedule in their vicinity and the likelihood of excess noise during these periods, specifying the anticipated periods during which these impacts will affect them.								

	Impact mitigation						Performance and impact monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures (MM)**	**Responsible for Implementation**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter for monitor**	**Frequency & Verification**	**Responsible to Monitor**	**Monitoring Cost**
Blasting and Vibration		1. In the event, the blasting is required due to unavoidable circumstances then only non-explosive chemical based blasting material will be used for rock breaking, which will not generate any noise or vibration	Contractor	If blasting is required- prior to and during blasting procedure	Project sites	Cost included in contracts	Check implementation of items 1	During blasting activity	PIU Thimphu Thromde Environmental Officer, PIU, Thimphu Thromde Road engineers	PIU Budgets
Water Quality		A. Lubricants will be stored in containers /dedicated enclosures with a sealed floor >50m from water bodies B. Solid waste from construction activities will not be thrown in rivers. C. Construction storage/stockpiles will be provided with bunds to prevent silted run-off. D. Stockpiled materials will be covered to reduce run-off. E. Washing of machinery and vehicles in surface waters will be	Contractor	Throughout construction phase	Project sites	Cost included in contracts	Check implementation of items 1-5	Daily during construction	PIU Thimphu Thromde Environmental Officer,	PIU Budgets

	Impact mitigation						Performance and impact monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures (MM)**	**Responsible for Implementation**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter for monitor**	**Frequency & Verification**	**Responsible to Monitor**	**Monitoring Cost**
		prohibited.								
Construction camps and canteen facilities		1)Not to site construction camps too close to the local communities to avoid unwanted interference to the way of living of the local communities. Construction camps will be placed in a proper location in consultation with PIU. 2)Adequate drinking water supply, basic food items, and cooking fuel (such as kerosene) will be provided to ward off competition on local resources. 3)For maintenance of proper health and hygiene adequate number of pit latrines and garbage cans will provided. 4)Fishing, hunting and illegal tree felling will be totally prohibited. 5)After completion of construction, the abandoned campsite will be cleaned and restored to the	Contractor	Throughout construction phase	Labour camps (if any)	Cost included in contracts	Check implementation of items 1-5	Daily during construction	PIU Thimphu Thromde Environmental Officer,	PIU Budgets

	Impact mitigation						Performance and impact monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures (MM)**	**Responsible for Implementation**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter for monitor**	**Frequency & Verification**	**Responsible to Monitor**	**Monitoring Cost**
		original state. If a campsite is a government barren land then contractor will carry out compensatory plantation with suitable local or native plant species.								
Sanitation and disease prevention		i. Employ measures to prevent proliferation of mosquitoes (e.g., provision of insecticide treated mosquito nets to workers, installation of proper drainage to avoid formation of stagnant water, etc.) ii. Standing water will not be allowed to accumulate in the temporary drainage facilities or along the roadside, to prevent proliferation of mosquitoes. iii. Temporary and permanent drainage facilities will be designed to facilitate the rapid removal of surface water from all areas and prevent the accumulation of	Contractor	Throughout construction phase	Project sites and labour camps if any	Cost included in contracts	Check implementation of items 1-6	Daily during construction	PIU Thimphu Thromde Environmental Officer,	PIU Budgets

	Impact mitigation						Performance and impact monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures (MM)**	**Responsible for Implementation**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter for monitor**	**Frequency & Verification**	**Responsible to Monitor**	**Monitoring Cost**
		surface water ponds. iv. HIV-AIDS awareness or education will be implemented in line with social programmes and plans for the Project and HIV/AIDS awareness and prevention program shall be implemented in line with plans from the social work stream v. Sanitation facilities such as construction of pit latrines and solid waste collection and disposal will be implemented. vi. Health checkup or screening of the imported labourers will be carried out as per the existing practices to stop spread of TB.								
Occupational Health and Safety										
Physical hazards		i. Routing of traffic to alternative roads where possible ii. Closure of lanes and diversion of traffic to the	Contractor	Throughout construction phase	Project sites.	Cost included in contracts	Check implementation of items 1-15	Daily during construction	PIU TT Environmental Officer,	PIU Budgets

	Impact mitigation						Performance and impact monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures (MM)**	**Responsible for Implementation**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter for monitor**	**Frequency & Verification**	**Responsible to Monitor**	**Monitoring Cost**
		remaining lanes if the road is wide enough (e.g. rerouting the all traffic to one side of the road) iii. Where worker exposure to traffic cannot be completely eliminated, use of protective barriers to shield workers from traffic vehicles, or installation of channeling devices (e.g. traffic cones and barrels) to delineate work zone iv. Design of work space to eliminate or decrease blind spots v. Reduction of maximum vehicle speeds in working zones vi. Workers shall be provided with appropriate personnel safety equipment such as safety boots, helmets, gloves, protective clothes, dust mask,								

	Impact mitigation						Performance and impact monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures (MM)**	**Responsible for Implementation**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter for monitor**	**Frequency & Verification**	**Responsible to Monitor**	**Monitoring Cost**
		goggles, and ear protection at no cost to the workers. vii. Conducting training (assisted by PIU) for all workers on safety and environmental hygiene at no cost to the employees. iii. The contractor will instruct workers in health and safety matters as required by law and by good engineering practice and provide first aid facilities. This will include construction camp rules and site agents/foremen will follow up with toolbox talks on a regular basis. ix. Workforce training for all workers starting on site will include safety and environmental hygiene. x. When operating power tools at height, workers should use a second (backup)								

	Impact mitigation						Performance and impact monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures (MM)**	**Responsible for Implementation**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter for monitor**	**Frequency & Verification**	**Responsible to Monitor**	**Monitoring Cost**
		safety strap. xi. Fencing on all areas of excavation greater than 1m deep and sides of temporary works shall be observed. xii. Contractor will at all-time keep the first aid kit at the construction sites. iii. Contractor will be responsible for evacuation injured person to the nearest medical center and bear all the medical expenses iv. Reversing signals shall be installed on all construction vehicles and plant.								
Chemical hazards		▪ Use correct asphalt product for each specific application, and ensure application at the correct temperature to reduce fuming of bitumen during normal handling ▪ Maintenance of work vehicles and machinery to minimize air emissions ▪ Reduction of	Contractor	Throughout construction phase	Project sites.	Cost included in contracts	Check implementation of items 1-6	Daily during construction	PIU TT Environmental Officer,	PIU Budgets

	Impact mitigation						Performance and impact monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures (MM)**	**Responsible for Implementation**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter for monitor**	**Frequency & Verification**	**Responsible to Monitor**	**Monitoring Cost**
		engine idling time at construction sites ▪ Use of extenders or other means to direct exhaust away from the operator ▪ Use of protective clothing when working with cutbacks (a mixture of asphalt and solvents for the repair of pavement), diesel fuel or other solvents ▪ Avoiding the use of lead containing paint and using appropriate respiratory protection when removing paints (including those containing lead in older installations) or when cutting galvanized steel.								
Noise	Ensure that workers are not exposed to unsafe noise levels.	• Undertake noise control measures including the use of personal hearing protection by exposed personnel, implementation of work rotation programs to reduce cumulative impacts and installing	Contractor	Throughout construction phase	Project sites	Cost included in contracts	Check if noise level exceed NEC standards and monitor noise reduction measures.	Bi-weekly during construction	PIU Thimphu Thromde Environmental Officer,	PIU Budgets

	Impact mitigation						Performance and impact monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures (MM)**	**Responsible for Implementation**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter for monitor**	**Frequency & Verification**	**Responsible to Monitor**	**Monitoring Cost**
		suitable mufflers on engine exhausts and compressor component.								
Public health and safety		❑ Construction sites near to settlements will be adequately provided safety barriers and proper signage ❑ Safe corridors for pedestrians must be provided along the road alignments. ❑ Safe crossing areas should be designated and marked for pedestrians and cyclists. ❑ Barriers must be installed to deter pedestrians' access to construction sites, except at designated crossing points. ❑ Traffic calming devices and speed controls must be installed and maintained at pedestrian crossing sites. ❑ Traffic must be adequately regulated (eg through signs,	Contractor	Throughout construction phase	Project sites, especially around sensitive areas where pedestrian safety issues are critical.	Cost included in contracts	Check implementation of items 1-11	Daily during construction	PIU Thimphu Thromde Environmental Officer,	PIU Budgets

	Impact mitigation						Performance and impact monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures (MM)**	**Responsible for Implementation**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter for monitor**	**Frequency & Verification**	**Responsible to Monitor**	**Monitoring Cost**
		signals, markings) near critical pedestrian zones or bikeways. ❑ Construction activities will be timed and provision for safe passage of school children and elderly will be provided. ❑ At sensitive locations pedestrian movement will guided by the security personnel. ❑ Excavated trenches/ditches and freshly cut steep side slopes will be clearly marked and fenced for the safety of passersby and workers alike. ❑ Project or construction vehicles will be briefed on speed limit within sensitive areas such as schools, commercial and residential areas. ❑ In event of accidents, the contractor will be responsible for								

	Impact mitigation						Performance and impact monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures (MM)**	**Responsible for Implementation**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter for monitor**	**Frequency & Verification**	**Responsible to Monitor**	**Monitoring Cost**
		immediate evacuation of injured person to the nearest medical center. The contractor shall bear medical and other expenses of the injured person.								
Traffic safety and management		❑ Traffic management plan for construction period to be developed ❑ Local communities to be informed about the traffic management measures that will be in place during the period of the construction.	Contractor in consultation with TT, PMU, RSTA, and local communities.	Prior to commencement of construction works.	Project sites.	Cost included in contracts	Check implementation of items 1-2	The plan should be in place prior to starting the construction works in each spot section	PIU Thimphu Thromde Environmental Officer,	PIU Budgets
Emergency preparedness		i. Prepare an emergency preparedness and response plan in coordination with the local community and local emergency responders to provide timely first aid response in the event of accidents and hazardous materials response in the event of spills.	Contractor	Prior to commencement of construction works.	Project sites.	Cost included in contracts	Check implementation of items 1	The plan should be in place prior to starting the construction	PIU Thimphu Thromde Environmental Officer,	PIU Budgets
Archaeological and		Should any potential items be located, the	Contractor	As and when such	Project sites.	Cost included	Check implement	Bi-weekly	PIU Thimphu	PIU Budgets

	Impact mitigation						Performance and impact monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures (MM)**	**Responsible for Implementation**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter for monitor**	**Frequency & Verification**	**Responsible to Monitor**	**Monitoring Cost**
cultural artefacts		PMU and Thimphu thromde will immediately be contacted and work will be temporarily stopped in that area. i. If the site supervisor determines that the item is of potential significance, an officer from the MOHCA will be invited to inspect the site and work will be stopped.= ii. Until MOHCA has responded to this invitation work will not re-commence in this location until agreement has been reached between MOHCA, PMU and Thimphu thromde as to any required mitigation measures, which may include excavation.		a situation occurs		in contracts	ation of items 1-3		Thromde Environmental Officer, PIU to closely monitor such chance finds.	
Access structures		i. Provide temporary access to properties whose access structures are encroaching ROW, and reinstate permanent access to such properties (outside of ROW) post completion of construction works. ii. Provision of temporary access facilities to								

	Impact mitigation						Performance and impact monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures (MM)**	**Responsible for Implementation**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter for monitor**	**Frequency & Verification**	**Responsible to Monitor**	**Monitoring Cost**
		properties which will be affected during construction works, through use of crossing planks etc.								
OPERATION STAGE										
Noise	Ensuring that excess noise levels do not cause nuisance to residents.	i. Noise barrier will be installed if needed in future	TT	Regularly throughout during O&M period.	Project area	Cost included in PIU Budgets	Noise levels do not exceed NEC standards; noise related complaints received from Thimphu residents.	Post construction	Thimphu Thromde	Thimphu Thromde budgets
Gaseous Emission	To prevent severe air pollution that is harmful to human health	i. Ensuring that vehicles undertake mandatory pollution checking and maintenance procedures. ii. Undertake air quality monitoring	TT, RSTA	Regularly through out O&M period.	Project area	Cost included in PIU Budgets	Ambient air quality	Post construction	Thimphu Thromde	Thimphu Thromde budget
Particulate emissions	Controlling the level of particulate emissions.	A. The road surface will be maintained for smooth traffic flow and reduction of vehicular emission B. Undertake air quality monitoring	1. TT 2. RSTA	Regularly throughout O&M period.	Project area	Cost included in PIU and RSTA Budgets	Concentration of particulate matter in the air	Post construction	Thimphu Thromde	Thimphu Thromde budget
Soil erosion and water		• Storm water	TT	Regularly throughout	Project area	Cost included	Regular maintenan	Post constructio	Thimphu Thromde	Thimphu Thromde

	Impact mitigation						Performance and impact monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures (MM)**	**Responsible for Implementation**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter for monitor**	**Frequency & Verification**	**Responsible to Monitor**	**Monitoring Cost**
pollution		drainage to be maintained and surrounding vegetation to be maintained in good working condition • Routine cleaning of the existing drains and water bodies.		during O&M period.		in PIU Budgets	ce of drains and vegetation along ROW	n		budget
Driving conditions and community safety		I. Zebra crossings to be maintained II. Pedestrian footpath to be properly maintained	Thimphu Thromde	Regularly throughout during O&M period.	Project area	Cost included in PIU Budgets	Number of road accident decreased	Post constructio n	Thimphu Thromde, RSTA	Thimphu Thromde Budget, RSTA budget

131. **Environmental Costs.** Under the project the environmental cost will be integrated into the overall project cost. The provision for the environmental mitigation measures will be specified in the bidding documents and budget for construction related EMP will need to be included in the bids. This will ensure the proper implementation of environmental mitigation measures. The environmental monitoring, supervision and reporting cost will be part of the overall construction implementation and supervision cost to be borne by the contractor and the Thimphu Thromde and it will be integrated in the overall construction cost.

VII. CAPACITY ASSESSMENT

132. The environmental assessment process is established but environmental awareness and capability for implementation of EMP in infrastructure projects of the executing agency like Thimphu Thromde is in the very early stages of development. The environment division has been established in Thimphu Thromde. It is manned by the following staff:

(i)	Chief Environment Officer	-	1 No. (currently the post is vacant)
(ii)	Environment Officers	-	2 Nos.
(iii)	Civil Engineers		-2 Nos.
(iv)	Labour Officer	-	1 No.
(v)	Electrical Officers	-	2 Nos.
(vi)	Sanitary Inspectors	-	11 Nos.
(vii)	Transportation	-	2 pool vehicles with drivers

133. The Environment Division is in its early stage of existence and as such handling urban infrastructure projects is something that has not been taken up by the division. Most of the recruits are new and need support and guidance to carryout monitoring and supervision of urban project activities. Therefore, through this project, there is an opportunity to upgrade the knowledge and skills of the Environmental Division. The Engineering Division is responsible for planning, designing, and execution of various infrastructure projects under the Thimphu Thromde. Environment Division with trained environmental officers would be able to institutionalize the environmental assessment process; implementation of mitigation measures; and checking compliance and effective monitoring. Currently one of the engineers is officiating as Chief Environment Officer. One environment officer looks after the Environment Clearance issues and the office correspondence while the other looks after the solid waste. The Sanitary Inspectors are currently engaged in ensuring that no illegal hawkers operate in the Thromde and also checking on illegal solid waste disposals inside the Thimphu Thromde.

A. Capacity Building

134. Under the project, the Thimphu Thromde has agreed to assimilate the environmental assessment and monitoring under the project's institutional setup. Under these requirements appropriate trainings need to be imparted to the Thromde site engineers as well as the staff under the environment division so that they are equipped with the skills and knowledge on environmental monitoring of the works at site. Capacity building of the Thimphu Thromde officials for O&M and environmental monitoring are a key component of this grant project.

VIII. INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION

135. The objectives of the stakeholder consultation process was to disseminate information on the Project and its expected impact, long-term as well as short-term, among primary and secondary stakeholders and to gather information on relevant issues so that the feedback received could be used to address these issues at early stages of Project design. Another important objective was to determine the extent of the concerns amongst the community, to address these in the Project implementation and to suggest appropriate mitigation measures. The feedback received has been used to address these issues at early stages of Project design.

A. Identification of Stakeholders

136. The stakeholders consulted for the Project included local affected persons residing near the project sites and other stakeholders including the relevant government agencies. Individuals representing many persons from numerous family groups in the area along the alignment were informed about the Project and invited to comment on their environmental concerns. These stakeholders were considered to be representative of the community living in the area, the road users, the business associated with the road and the locally elected representatives. Subsequently further public consultations have taken place including meetings and discussions with authorities.

137. A total of 56 stakeholders have been consulted (23 men, 33 women). These were considered to be representative of most of the community living in the area. Consultations were also undertaken with the owners of the properties that may lose their access structures (ramps, steps) which are encroaching on the ROW to explain that the EMP will be taking care of maintaining their access during the construction period and providing alternative access for the properties to the roads when the works are completed. These consultations took place during first and second week of February 2016.

B. Consultation with Stakeholders

138. The results of the public consultations are recorded in Appendix B. The communities along the Project road indicated they would fully support the rehabilitation and improvement project. The main environmental concerns included traffic congestion, protecting water supplies, preventing damage to local electricity cables and other infrastructure and utilities existing in the surrounding construction areas. Increased traffic, emission of dust, traffic congestion and muddy condition during the rains are some of the other concerns of the stakeholders. Proper mitigation measures such as sprinkling of water to contain dust, proper management of traffic, mixing of bitumen not to be done at site and timely completion of the work will be enforced during project implementation to mitigate these negative impacts. Further information is provided in Appendix B.

C. Concerns Addressed

139. No major issues and concerns are envisaged in the project which cannot be addressed through the EMP. Any unforeseen impacts that may arise in future may warrant an update of the existing EMP and intimation to ADB for any response.

D. Information Disclosure and Participation

140. Minor concerns were expressed that the DES should disclose the road construction works in advance and that complaints monitoring will provide further opportunities for consultation and can assist in public participation. Providing information through local authority offices will provide a conduit for the improvement of the project implementation to better serve the stakeholders. Public consultation can also assist in:

(i) harnessing cooperation from informed people to help local authorities reconfirm the extent of local permits and licenses that will be required at a later stage; and
(ii) obtaining cooperation from informed residents and groups to avoid cost and time in dealing with complaints.

141. TT will disclose the IEE report to the public through their website to provide public an opportunity to review the project design and be engaged in further consultation if necessary. Similarly, ADB will disclose the final IEE on its Website for public dissemination.

IX. GRIEVANCE REDRESS MECHANISM

142. Immediately upon grant effectiveness, PIU, Thimphu Thromde will establish a GRM, acceptable to ADB. The GRM will aim to provide a time-bound and transparent mechanism to voice and resolve social and environmental concerns linked to the project.

143. Thimphu Thromde shall make the public aware of the GRM through public awareness campaigns. The contact phone number will serve as a hotline for complaints and shall be publicized through the media and placed on notice boards outside their offices. Information on the project shall be made available at the Thimphu Thromde office and a brochure/leaflet will be made available to include information on the GRM and it shall be disseminated to the local government offices, temples, schools and residential associations in Thimphu by the environmental/social safeguards officers in the Thimphu Thromde. Grievances can be filed in writing or by phone to any member of the Thimphu Thromde as well as the environmental/social safeguards officer.

144. **First tier of GRM.** A designated locally elected thromde representative shall be the channel through which complaints shall be lodged. Thereafter the PIU is the first tier of GRM which offers the fastest and most accessible mechanism for resolution of grievances. The Project Managers (PM/PIU) will be designated as the key officer for grievance redress. Resolution of complaints will be done within seven working (7) days. Investigation of grievances will involve site visits and consultations with relevant parties (e.g., affected persons, contractors, police, etc.) Grievances will be documented and personal details (name, address, date of complaint, etc.) will be included unless the person complaining requests for anonymity.

145. A tracking number shall be assigned for each grievance, including the following elements; (i) initial grievance sheet (including the description of the grievance), with an acknowledgement of receipt handed back to the complainant when the complaint is registered; (ii) grievance monitoring sheet, mentioning actions taken (investigation, corrective measures); (iii) closure sheet, one copy of which will be handed to the complainant after he/she has agreed to the resolution and signed-off. The updated register of grievances and complaints will be available to the public at the Thromde office. Should the grievance remain unresolved it will be escalated to the second tier.

146. **Second Tier of GRM.** The PM of respective sub-projects will activate the second tier of GRM by referring the unresolved issue (with written documentation) to Thromde Office who will pass unresolved complaints upward to the Grievance Redress Committee (GRC). The GRC shall be established by Thimphu Thromde before commencement of site works. The GRC will consist of the following persons: (i) Executive Secretary; (ii) Division Heads of Thimphu Thromde; (iii) Environmental Officer (iv) Project Coordinator; (v) Elected representative of the affected person(s); and (vi) representative of the Thromde Land Record Officer. A hearing will be called with the GRC, if necessary, where the affected person can present his/her concern/issues. The process will facilitate resolution through mediation. The local GRC will meet as necessary when there are grievances to be addressed. The local GRC will suggest corrective measures at the field level and assign clear responsibilities for implementing its decision within fifteen (15) working days. The contractor will have observer status on the committee. If unsatisfied with the decision, the existence of the GRC shall not impede the complainant's access to the Government's judicial or administrative remedies.

147. The functions of the local GRC with regards to environmental concerns are as follows: (i) resolve problems and provide support to affected persons arising from various environmental issues including issues, ; hampering conduct of business, utilities, power and water supply, waste disposal, traffic interference and public safety; (ii) reconfirm grievances of affected persons, categorize and prioritize them and aim to provide solutions within a month; and (iii) report to the aggrieved parties about developments regarding their grievances and decisions of the GRC.

148. The environment officer or the land record officer in Thimphu Thromde will be responsible for processing and placing all papers before the GRC, maintaining database of complaints, recording decisions, issuing minutes of the meetings and monitoring to see that formal orders are issued and the decisions carried out.

149. **Third tier of GRM.** In the event that a grievance cannot be resolved directly by the GRC the affected person can seek alternative redress through an appropriate court. The GRC will be kept informed by the Thromde authority. The monitoring reports shall include the following aspects pertaining to progress on grievances: (i) Number of cases registered with the GRC, level of jurisdiction, number of hearings held, decisions made, and the status of pending cases; and (ii) lists of cases in process and already decided upon may be prepared with details such as Name, ID with unique serial number, date of notice, date of application, date of hearing, decisions, remarks, actions taken to resolve issues and status of grievance.

X. CONCLUSIONS AND RECOMMENDATIONS

150. This IEE study reveals that the impacts from construction and development of the project are predictable and manageable; impacts can be avoided, or minimized. None of the project sites are located in environmentally sensitive areas and land acquisition or physical and/or economic displacement is not anticipated to be required for the implementation of the project. Based on the findings of the IEE, the classification of the subproject as Category B is confirmed, and no further special study or detailed EIA needs to be undertaken to comply with ADB SPS (2009). Since the work primarily involves re-surfacing of the existing roads no special approvals are required as per the RECOP annex II

151. The Environmental Management Plan (EMP) covers all aspects of construction and development. All relevant issues raised during the public consultations were incorporated in the

IEE and EMP. The detailed designs for the works in the four lots have already been made by Thimphu Thromde and the road widening detailed designs are currently under preparation. The EMP will need to be updated during the detailed design stage to include any changes in scope of works and accordingly the environmental impacts and mitigation measures will need to be updated. Environmental conditions shall be incorporated into the standard bidding documents and EMP shall be attached to the bidding documents. In case there are any significant changes the current EMP may need to be revised again during the construction to reflect any impacts that were not anticipated during the pre-construction stage. The contractors will be required to implement, update and monitor the EMP during the project construction period. Institutionalization of environmental compliance monitoring and capacity building of project and related staffs will be carried out during project implementation.

152. The proposed project will enable to improve traffic flows within Thimphu city thus reducing the inconvenience that the residents are currently facing due to the current poor road conditions. In addition, providing new pedestrian and drainage infrastructure will lead to urban environmental improvements as well as improvements in road safety for pedestrians. Over all, the project will improve the quality of life of the residents of Thimphu city and also generate economic benefits by better connectivity to socio-economic services. Therefore, this project is recommended for implementation as its implementation will improve the city economy by alleviating issues arising from poor road infrastructure.

Appendix 1: REA Checklist for TRIP

Rapid Environmental Assessment (REA) Checklist

Instructions:

(i) The project team completes this checklist to support the environmental classification of a project. It is to be attached to the environmental categorization form and submitted to the Environment and Safeguards Division (RSES), for endorsement by Director, RSES and for approval by the Chief Compliance Officer.

(ii) This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB's (a) checklists on involuntary resettlement and Indigenous Peoples; (b) poverty reduction handbook; (c) staff guide to consultation and participation; and (d) gender checklists.

(iii) Answer the questions assuming the "without mitigation" case. The purpose is to identify potential impacts. Use the "remarks" section to discuss any anticipated mitigation measures.

Country/Project Title: Bhutan/ Thimphu Road Improvement Project

Sector Division: South Asia Urban and Water

Screening Questions	Yes	No	Remarks
A. Project Siting Is the project area adjacent to or within any of the following environmentally sensitive areas?			
▪ Cultural heritage site		X	
▪ Protected Area		X	
▪ Wetland		X	
▪ Mangrove		X	
▪ Estuarine		X	
▪ Buffer zone of protected area		X	
▪ Special area for protecting biodiversity		X	
B. Potential Environmental Impacts Will the Project cause…			
▪ encroachment on historical/cultural areas; disfiguration of landscape by road embankments, cuts, fills, and quarries?		X	
▪ encroachment on precious ecology (e.g. sensitive or protected areas)?		X	

Screening Questions	Yes	No	Remarks
▪ alteration of surface water hydrology of waterways crossed by roads, resulting in increased sediment in streams affected by increased soil erosion at construction site?	X		Inclusion of drainage works in critical areas will help reduce flooding risks in these sections.
▪ deterioration of surface water quality due to silt runoff and sanitary wastes from worker-based camps and chemicals used in construction?	X		There maybe siltation of natural streams located in the vicinity of project sites during construction and operation and mitigation measures have been proposed in the EMP.
▪ increased local air pollution due to rock crushing, cutting and filling works, and chemicals from asphalt processing?	X		Dust generation from earthworks and rock crushing and fumes from equipment and construction vehicles would be unavoidable. Rock crushing and asphalt processing will be sited away from settlements and other sensitive receptors. Measures to minimize local air pollution problems have been proposed in the EMP.
▪ risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological hazards during project construction and operation during project construction and operation?	X		Although, the scale of construction works is relatively small, occupational health and safety (OHS) risks have still been taken into consideration and mitigation measures have been proposed in the EMP.
▪ noise and vibration due to blasting and other civil works?	X		Although, the use of blasting is not proposed under the project, noise and vibration will be generated from construction works. Measures for minimizing this nuisance have been identified in the EMP.
▪ dislocation or involuntary resettlement of people?		X	
▪ dislocation and compulsory resettlement of people living in right-of-way?		X	
▪ disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		X	Currently, no specific vulnerable groups have been identified in the project areas.
▪ other social concerns relating to inconveniences in living conditions in the project areas that may trigger cases of upper respiratory problems and stress?		X	With strict occupational health and safety requirements, restrictions on construction timing and mitigation measures against dust and other forms of pollution, serious concerns on respiratory problems and stress are not expected.
▪ hazardous driving conditions where construction interferes with pre-existing roads?	X		There will be disruptions to traffic flows during the construction works. Provisions for undertaking traffic management plans and actions for enhancing pedestrian safety during the construction phase have been incorporated into the EMP.

Screening Questions	Yes	No	Remarks
▪ poor sanitation and solid waste disposal in construction camps and work sites, and possible transmission of communicable diseases (such as STI's and HIV/AIDS) from workers to local populations?	X		It is not known at this stage if construction camps will be required or not. It may be that foreign or regional workers will need to be imported. However, in Bhutan it is mandatory for all imported workers to go through health screening test for diseases such as STI, HIV.AIDS before issuing permits allowing them to enter the country. This screening procedure undertaken by the government reduces significantly the risk of spread of such kind of diseases. Never the less awareness campaigns on HIV/AIDS and other health concerns (including proper hygiene) will be conducted under the project. Poor sanitation and waste issues in camps will be addressed through provisions for hygiene and waste management requirements identified in the EMP.
▪ creation of temporary breeding habitats for diseases such as those transmitted by mosquitoes and rodents?		X	
▪ accident risks associated with increased vehicular traffic, leading to accidental spills of toxic materials?	X		The accident risks are associated with the disruptive nature of works which will affect normal traffic flows. Appropriate road safety measures are included in the designs and provisions for reducing accidents and hazards have been identified in the EMP.
▪ increased noise and air pollution resulting from traffic volume?	X		There will be creation of noise and air pollution in the project area during the construction phase. Appropriate mitigation measures have been outlined in the EMP.
▪ increased risk of water pollution from oil, grease and fuel spills, and other materials from vehicles using the road?	X		Daily traffic flows are likely to contribute to generation of oil, grease etc. which can pollute water sources nearby. Appropriate mitigation measures have been identified in the EMP.
▪ social conflicts if workers from other regions or countries are hired?		X	
▪ large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?		X	
▪ risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during construction and operation?	X		Transport, storage and use of hazardous materials and chemicals are a major concern due to the potential hazards. Appropriate measures for safe transport, storage, handling and controlled use of these materials is included in the EMP.

Screening Questions	Yes	No	Remarks
▪ community safety risks due to both accidental and natural causes, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning.	X		Construction schedules and proposed traffic re-routings/ diversions will be made public by outreach efforts undertaken by the Thimphu thromde. Clear signs and measures to restrict access to hazardous areas will be put into place. The EMP also has additional provisions to ensure safety of passerby as well as construction workers.

A Checklist for Preliminary Climate Risk Screening

Country/Project Title:

Sector :

Subsector:

Division/Department:

Screening Questions		Score	Remarks[17]
Location and Design of project	Is siting and/or routing of the project (or its components) likely to be affected by climate conditions including extreme weather related events such as floods, droughts, storms, landslides?	1	Some project location may experience increased flooding during high rain season. However, no project components are sited in flood plains and road specifications have been designed taking into account increased risk of water logging.
	Would the project design (e.g. the clearance for bridges) need to consider any hydro-meteorological parameters (e.g., sea-level, peak river flow, reliable water level, peak wind speed etc)?	0	Proposed investments will not pass through riverine areas.
Materials and Maintenance	Would weather, current and likely future climate conditions (e.g. prevailing humidity level, temperature contrast between hot summer days and cold winter days, exposure to wind and humidity hydro-meteorological parameters) likely affect the selection of project inputs over the life of project outputs (e.g. construction material)?	1	Areas with high risk of flooding have been prioritized for undertaking drainage works. Road specifications have been designed taking into account risk of increased flooding.
	Would weather, current and likely future climate conditions, and related extreme events likely affect the maintenance (scheduling and cost) of project output(s) ?	1	Detailed climate modelling studies have not been undertaken. However, road asset maintenance is likely going to be affected by the projected increase in flooding risks affecting certain project sites.
Performance of project outputs	Would weather/climate conditions, and related extreme events likely affect the performance (e.g. annual power production) of project output(s) (e.g. hydro-power generation	1	Likely road blockages may occur during extreme weather events.

[17] If possible, provide details on the sensitivity of project components to climate conditions, such as how climate parameters are considered in design standards for infrastructure components, how changes in key climate parameters and sea level might affect the siting/routing of project, the selection of construction material and/or scheduling, performances and/or the maintenance cost/scheduling of project outputs.

	facilities) throughout their design life time?		

Options for answers and corresponding score are provided below:

Response	Score
Not Likely	0
Likely	1
Very Likely	2

Responses when added that provide a score of 0 will be considered low risk project. If adding all responses will result to a score of 1-4 and that no score of 2 was given to any single response, the project will be assigned a medium risk category. A total score of 5 or more (which include providing a score of 1 in all responses) or a 2 in any single response, will be categorized as high risk project.

Result of Initial Screening (Low, Medium, High):_Medium

Other Comments: Project team, with support from SDCC colleagues, used AWARE to confirm the climate risk rating, which was 'high'. However, climate model projections do not agree that seasonal precipitation will increase in the project locations which could indicate a relatively high degree of uncertainty for some of the risks indicated in the AWARE analysis (eg-snow loading). Therefore, the overall risk is deemed to be medium. The major risk from climate change is projected increase in the frequency and intensity of flood events. Engineering designs have been prepared taking into account the increased risks from flooding. In addition to these hard design features the project will also support the improvement of the institutional abilities of the municipality officials for the sustainable operation and maintenance of road infrastructure (including enhanced capacity for environmental monitoring).

Prepared by: __Ninette Pajarillaga_____

Appendix 2: Summary of Stakeholder Consultations

Brief discussions/consultations about the project were jointly carried out with the Social Safeguards Specialist in the four zones during first to mid February 2016. Participants/residents, motorists (either in groups or at individual level) were briefed about the components that the project would be taking up. It was briefed that the project components were an effort to rehabilitate the existing infrastructures and in some case constructing new facilities such as new drains and foot paths. The infrastructures rehabilitation has been positively viewed by the residents as it would make their life better and easier.

The following were some of the feedback received from the participants:

(i) Since these activities are taking place in the urban areas, it is essential to complete the works within time.
(ii) Emissions of dust and dirt from the construction sites need to be taken care of.
(iii) Concerns were raised on the activities to be taken up by the project. Since the project was taking up road, drain and foot path, infrastructures such as sewerage and drinking water supply will have to be laid at a later date. Digging the road might damage or destroyed the existing sewerage system, drinking water supply pipes or even telecom/electricity facilities, causing inconvenience to the public. These aspects could be looked into by the project during implementation phase.
(iv) Once such tasks are undertaken by the Thromde, the quality aspect should be a priority since digging the roads again and again will cause a lot of problems in the areas.
(v) Drinking water supply pipes should not be allowed to be laid in the drains or overheads as they block the drains and let the drain water run on to the roads.
(vi) The heights of foot paths to be at appropriate levels as they get destroyed by motorists.
(vii) Digging of roads once rehabilitated should not be allowed unless necessary.
(viii) Size of drains to be big enough to carry the rain water during rainy season.
(ix) Crash barriers to in place along the YHS to Semtokha stretch for the safety of the houses below the road.
(x) Sewerage connections to be provided as often the over flows from septic tanks on to the roads causes public nuisance.
(xi) Street lights at appropriate places to installed for the safety of the pedestrians.
(xii) Often approach to private buildings block the drain which leads to the flow of the drain water onto the streets.
(xiii) Avoid damages to private properties during execution of project works.
(xiv) There will be traffic diversion causing delays and inconvenience to road users during resurfacing works, including air pollution.

Table 1: List of Stakeholders Consulted

Sl. No.	Name	Area	Remarks
1	Nechenmo	Above NPPF colony	Zone 3
2	Gyem Dorji	Above NPPF colony	
3	Tshering Dhendup	Olakha bridge	Olakha
4	Khandu	Olakha bridge	
5	Wangmo	Olakha bridge	
6	Sonam Peldin	Olakha Bridge	
7	Aum Gaki	Old highway down	
8	Dago Retty	Old highway down	
9	Pema Choden	Old highway down	
10	Sangay Dema	Old highway down	
11	Dechen C	Babesa 2nd parallel road	Babesa
12	Gyeltshen	Babesa 2nd parallel road	
13	Kinley Wangmo	FCB Junction to cypress tree	Zone 3
14	Pasang	FCB Junction to cypress tree	
15	Chokey Dorji	FCB Junction to cypress tree	
16	Yangchen	Above BPPL junction	
17	Kinzang Lhamo	Above BPPL junction	
18	Tshering Bida	Above BPPL junction	
19	Sonam Tashi	Milk booth to Sangay enterprise	Zone 1
20	Pema Wangmo	Milk booth to Sangay enterprise	
21	Tshewang Zangmo	Milk booth to Sangay enterprise	
22	Mitsee Wangmo	Milk booth to Sangay enterprise	
23	Gyelpo	YHS Junction to Semtokha	Road widening
24	Wangda	YHS Junction to Semtokha	
25	Nedup	YHS Junction to Semtokha	
26	Thinley Lhamo	YHS Junction to Semtokha	
27	Kesang Tobgay	1st parallel road to Express-way Babesa	Babesa
28	Bidha	1st parallel road to Express-way Babesa	
29	Tashi Tobgay	Medical depot to Army saw mill	Zone 3
30	Pema Wangmo	Medical depot to Army saw mill	
31	Tauchu	Kalabazar B	
32	Kinzang Zangmo	Kalabazar B	
33	Domang Tshomo	Kalabazar A	
34	Pabitra Devi	Kalabazar A	
35	Lhadon	Supreme court gate to Dzong	Zone 2
36	Sonam Yuden	Supreme court gate to Dzong	
37	Leki Wangmo	Supreme court gate to Dzong	

Sl. No.	Name	Area	Remarks
38	Ugyen	Kinzang Lam (below Motithng BOB)	
39	Kabita Rai	Kinzang Lam (below Motithng BOB)	
40	Ratna Bahadur Tiwari	Kinzang Lam (below Motithng BOB)	
41	Dupthob Wangchu	Kinzang Lam (below Motithng BOB)	Zone 1
42	Wangchu Dema	Azhi's area (Motithang)	
43	Tshering Dorji	Azhi's area (Motithang)	
44	Dechen Wangzom	Azhi's area (Motithang)	
45	Dechen Wangmo	Azhi's area (Motithang)	
46	Dawa Pem	Samtenling gate to Bridge	
47	Sangay Dhendup	Samtenling gate to Bridge	Zone 2
48	Deki Tshomo	Samtenling gate to Bridge	
49	Dorji Wangchu	Kawajansa (below ACC)	
50	Jamphel Choeda	Kawajansa (below ACC)	
51	Ganesh Pradhan	Kawajansa (below ACC)	
52	Tshering Dema	Kawajansa (below ACC)	
53	Rajan Bista	RENEW Junction to Education junction at Kawajangsa	Zone 1
54	Pema Tshomo	RENEW Junction to Education junction at Kawajangsa	
55	Sangay Zangmo	RENEW Junction to Education junction at Kawajangsa	
56	Tsheten Zangmo	RENEW Junction to Education junction at Kawajangsa	

Appendix 3: Environmental Criteria and Standards

I. Ambient Air Quality Standards (Maximum Permissible Limits in (µg/m^3)

Environmental Standards, National Environmental Commission, Royal Government of Bhutan, Nov 2010

Parameter	Industrial Area	Mixed Area*	Sensitive Area**
Total Suspended Particulate matter	500	200	100
24 Hour Average	360	140	70
Yearly Average			
Respiratable Particulate matter (PM10)			
24 Hour Average	200	100	75
Yearly Average	120	60	50
Sulfur Dioxide			
24 Hour Average	120	80	30
Yearly Average	80	60	15
Nitrogen Oxides			
24 Hour Average	120	80	30
Yearly Average	80	60	15
Carbon Monoxide			
8 Hour Average	5,000	2,000	1,000
1 Hour Average	10,000	4,000	2,000

* Mixed Area means where residential, commercial or both activities take place
**Sensitive Area means where sensitive targets are in place like hospitals, Schools, sensitive ecosystems.
Source: Environmental Standards, National Environmental Commission, Royal Government of Bhutan, Nov 2010

II. Noise Level Limits:

Industrial Area		Mixed Area		Sensitive Area	
Day *	**Night ****	**Day**	**Night**	**Day**	**Night**
75 dB (A)	65 dB (A)	65 dB (A)	55 dB (A)	55 dB (A)	45 dB (A)

Note: All the values are maximum values
*Day time is from 0600 hours to 2200 hours (human activities) **Night time is from 2200 hours to 0600 hours (no human activities).
Source: Environmental Standards, National Environmental Commission, Royal Government of Bhutan, Nov 2010.

III. Vehicle Emission Standards:

Fuel Type	Vehicle registered prior to 01st Jan 2005	Vehicle registered after 01st Jan 2005	Type Approval
Petrol (% CO)	4.5	4	Euro II
Diesel (% HSU)	75	70	

Source: Environmental Standards, National Environment Commission, Royal Government of Bhutan, Nov. 2010.

IV. Ambient Water Quality Criteria for various uses (September, 2010)

Sl. No.	Parameters	A	B	C
1	pH	6.5-8.5	6 to 9	6 to 9

Sl. No.	Parameters	A	B	C
2	Colour, Hz Units	5	50	-
3	TSS mg/l	25	100	-
4	Conductivity, µS/cm	800	1000	2000
5	Odour	Unobjectionable	Unobjectionable	-
6	Mineral Oil	No film	No film	-
7	Nitrate, mg/l	10	50	-
8	Flouride, mg/l	1	2	-
9	Sulphates, mg/l	25	100	-
10	Chloride, mg/l	50	200	-
11	Surfactants, mg/l	0.1	0.2	-
12	Phosphates, mg/l	0.5	<1.0	-
13	DO, mg/l	6	4	-
14	BOD, mg/l	2	5	50
15	TKN, mg/l	0.5	2	
16	Ammonia, mg/l	0.05	0.5	
17	T. Coliform, MPN/100 ml*	50	5000	10000
18	F. Coliform, MPN/100 ml*	20	2000	5000
19	F.streptococci, MPN/100 ml*	20	1000	1000
20	Dissolved Iron, mg/l	0.2	0.5	-
21	Copper, mg/l	0.05	0.1	-
22	Zinc, mg/l	0.2	0.5	
23	Arsenic, mg/l	0.01	0.05	-
24	Cadmium, mg/l	0.003	0.003	-
25	Total-Chromium, mg/l	0.05	0.05	-
26	Lead, mg/l	0.02	0.02	-
27	Selenium, mg/l	0.01	0.01	-
28	Mercury, mg/l	0.0005	0.0005	-
29	Phenol, mg/l	0.001	0.002	-
30	Cyanides	0.05	0.05	-
31	PAH, mg/l	0.0002	0.0002	0.001
32	Total Pesticides, mg/l	0.0005	0.0005	0.001
33	PCB mg/l	0.0002	0.0002	-
34	SAR	-	-	-
35	Boron	-	-	1
36	Floating Materials such as wood, plastic, rubber, excreta, garbage etc.	Absent	Absent	Absent

Source: Environmental Standards, National Environmental Commission, Royal Government of Bhutan,
Note:

1. (Very good) Drinking water source without conventional treatment, but after disinfection whenever necessary.
2. (Good) Drinking water source without conventional treatment.
3. (Moderate) Use for irrigation, industrial cooling etc.
4. To achieve the drinking quality standards, disinfection/ boiling of the water is recommended. The total coli form may be high due to their contribution from natural sources like soil, litter, etc., which does not relate to pathogen. If

MPN of total coli form is noticed to be more than the limit suggested, than regular test should be carried out. The criteria would be satisfied if during a period not more than 5 % sample shows greater than prescribed limit.